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N74-10001— N74-10904

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Beginning with this issue, the Notations of Content (NOC's) will no longer appear in the Subject Index nor in other current NASA information products. Instead, the titles of the referenced documents will be used, with a synthesized title extension added in those cases in which the title is insufficiently descriptive. The user should find that this change will enhance the utility and relevance of the Subject Index.

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IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates, postpaid:

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INDEXING VOCABULARY

The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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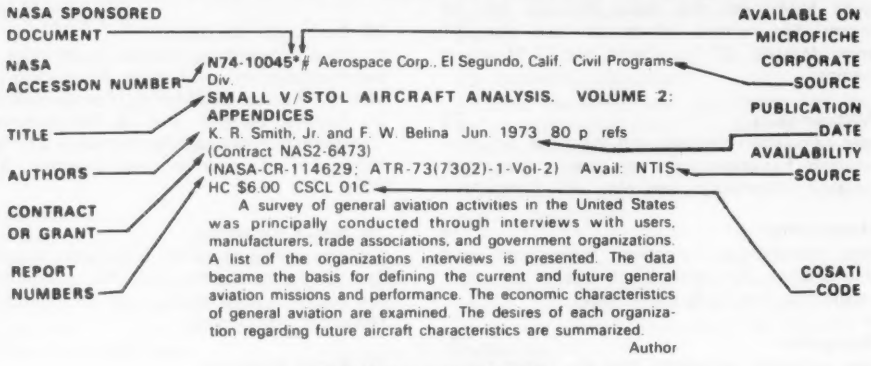

N74-10045*# Aerospace Corp., El Segundo, Calif. Civil Programs Div.

SMALL V/STOL AIRCRAFT ANALYSIS. VOLUME 2: APPENDICES

K. R. Smith, Jr. and F. W. Belina Jun. 1973 80 p refs (Contract NAS2-6473)

(NASA-CR-114629; ATR-73(7302)-1-Vol-2) Avail: NTIS HC $6.00 CSCL 01C

A survey of general aviation activities in the United States was principally conducted through interviews with users, manufacturers, trade associations, and government organizations. A list of the organizations interviews is presented. The data became the basis for defining the current and future general aviation missions and performance. The economic characteristics of general aviation are examined. The desires of each organization regarding future aircraft characteristics are summarized.

Author

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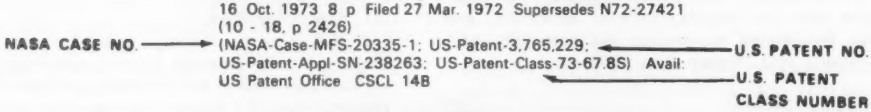


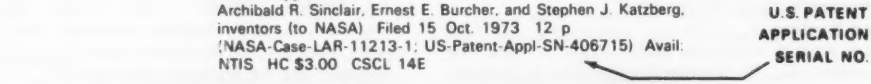
N74-10415* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

ULTRASONIC SCANNER FOR RADIAL AND FLAT PANELS Patent

Robert L. Spencer and Ewing K. Hill, inventors (to NASA) Issued 16 Oct. 1973 8 p Filed 27 Mar. 1972 Supersedes N72-27421 (10 - 18, p 2426)

(NASA-Case-MFS-20335-1; US-Patent-3,765,229; US-Patent-Appl-SN-238263; US-Patent-Class-73-67.8S) Avail: US Patent Office CSCL 14B

PATENT APPLICATION CITATION



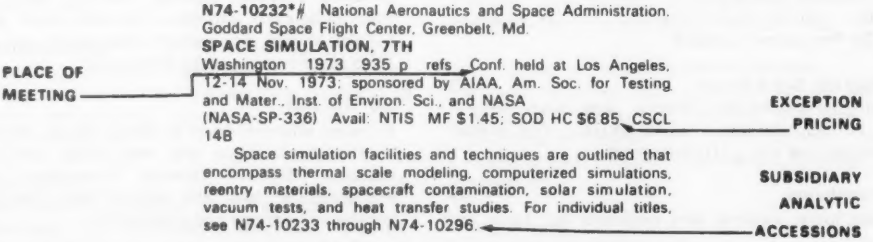
N74-10420*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AUTOMATIC FOCUS CONTROL FOR FACSIMILE CAMERAS Patent Application

Archibald R. Sinclair, Ernest E. Burcher, and Stephen J. Katzberg, inventors (to NASA) Filed 15 Oct. 1973 12 p

(NASA-Case-LAR-11213-1; US-Patent-Appl-SN-406715) Avail: NTIS HC $3.00 CSCL 14E

PRIMARY ANALYTIC CITATION AND ABSTRACT



N74-10232*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

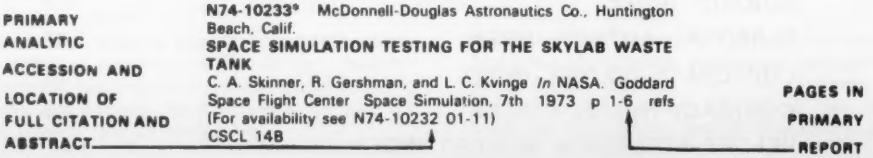
SPACE SIMULATION, 7TH

Washington 1973 935 p refs Conf. held at Los Angeles, 12-14 Nov. 1973; sponsored by AIAA, Am. Soc. for Testing and Mater., Inst. of Environ. Sci., and NASA

(NASA-SP-336) Avail: NTIS MF $1.45; SOD HC $6.85 CSCL 14B

Space simulation facilities and techniques are outlined that encompass thermal scale modeling, computerized simulations, reentry materials, spacecraft contamination, solar simulation, vacuum tests, and heat transfer studies. For individual titles, see N74-10233 through N74-10296.

SUBSIDIARY ANALYTIC CITATION



N74-10233* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

SPACE SIMULATION TESTING FOR THE SKYLAB WASTE TANK

C. A. Skinner, R. Gershman, and L. C. Kvinge *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 1-6 refs (For availability see N74-10232 01-11) CSCL 14B

VOLUME 12 NUMBER 1 / JANUARY 8, 1974

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N74-10001*+ National Aeronautics and Space Administration, Washington, D.C.

AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 34

Aug. 1973 136 p refs

(NASA-SP-7037(34)) Avail: NTIS HC $4.50 CSCL 01A

This special bibliography lists 462 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1973. Author

N74-10002 Engineering Sciences Data Unit, London (England).

CONVERSION FACTOR FOR PROFILE DRAG INCREMENT FOR PART-SPAN FLAPS

Feb. 1973 3 p ref

(ESDU-Flaps-02.01.07-Amend-A) Copyright. Avail: Issuing Activity

The conversion factor for deriving the drag increment of part-span flaps of all types from full-span flaps is plotted against the ratio of flap span to wing span. It is assumed that the flap chord to wing chord ratio is constant along the span. Graphs are presented for five aerodynamic configurations. Author

N74-10003 Engineering Sciences Data Unit, London (England).

LIFT COEFFICENT INCREMENT DUE TO FULL-SPAN SPLIT FLAP: FLAP CHORD 0.15c

Feb. 1973 2 p refs

(ESDU-Flaps-01.01.05-Amend-A) Copyright. Avail: Issuing Activity

The lift coefficient increment due to a full span split flap of chord 0.15c is plotted against flap angle for various thickness to chord ratios of the wings. When the flap is closed the trailing edge of the flap is coincident with the trailing edge of the wing. The flap refers to the deflection of the flap from the closed position. It was determined that the lift coefficient increment does not depend to a great extent on the wing section and is not sensitive to Reynolds number. Author

N74-10004 Engineering Sciences Data Unit, London (England).

INFORMATION ON THE USE OF DATA ITEMS IN THE SERIES WINGS 02.04

Jul. 1973 2 p

(ESDU-Wings-02.04.00-Amend-A) Copyright Avail: Issuing Activity

The aerodynamic conditions of profile drag, surface friction, and laminar boundary flow are discussed. The procedures and requirements involved in computing profile drag are explained. The effect of the mean position of transition points on the upper and lower surfaces of the wing is analyzed. The effects of waviness and surface roughness on the breakdown of laminar flow are described. Author

N74-10005 Engineering Sciences Data Unit, London (England).

INFORMATION ON THE USE OF DATA ITEMS ON ROLLING MOMENT DERIVATIVES OF AN AEROPLANE

Jul. 1973 2 p ref

(ESDU-Aircraft-06.01.00) Copyright. Avail: Issuing Activity CSCL 01A

The rolling moment derivatives of an aircraft due to rolling, yawing, and sideslip are discussed. The main assumptions and approximations for deriving the data are explained. The documents which concern the effects of dihedral angle, planform, body configuration, and fin and rudder reactions are idenfified. Author

N74-10006 Engineering Sciences Data Unit, London (England).

AERODYNAMIC CHARACTERISTICS OF AEROFOILS IN COMPRESSIBLE INVISCID AIRFLOW AT SUBCRITICAL MACH NUMBERS

Apr. 1973 15 p refs Sponsored by Roy. Aeron. Soc.

(ESDU-72024-Amend-A) Copyright. Avail: Issuing Activity

The aerodynamic characteristics of airfoils in compressible, inviscid airflow at subcritical Mach numbers are discussed. Data for estimating the effect of air compressibility on the lift-curve slope at zero lift, the zero lift pitching moment coefficient, and the chordwise position of the aerodynamic center of the airfoil in inviscid flow are presented. Mathematical models, tables, and graphs are included to support the theoretical considerations. Author

N74-10007 Engineering Sciences Data Unit, London (England).

EFFECTS OF ISOLATED BODY AND WING-BODY INTERFERENCE ON ROLLING MOMENT DUE TO SIDESLIP

Jun. 1973 13 p refs Supersedes Aero-A.06.01.05 Sponsored by Roy. Aeron. Soc.

(ESDU-73006; Aero-A-06.01.05) Copyright. Avail: Issuing Activity

The effects of isolated body and wing-body interference on the rolling moment due to sideslip are discussed. The data apply to low speeds and to lift coefficients for which the flow over the wing-body combination remains fully attached. Mathematical models are developed to support the theoretical considerations. The data are presented in the form of tables and graphs. Author

N74-10008 Engineering Sciences Data Unit, London (England).

THE MEAN SKIN FRICTION COEFFICIENT FOR A ROUGH FLAT PLATE WITH A TURBULENT TWO-DIMENISONAL BOUNDARY LAYER IN COMPRESSIBLE ADIABATIC FLOW, WITH APPLICATION TO WEDGES, CYLINDERS AND CONES

Jul. 1973 19 p refs Supersedes Aero-W.02.04.08 and

Aero-W.02.04.10 Sponsored by Roy. Aeronaut. Soc.
(ESDU-73016; Aero-W.02.04.08; Aero-W.02.04.10) Copyright. Avail: Issuing Activity

Data for the mean skin friction coefficient of a perfectly insulated (adiabatic flow) flat plate with an aerodynamically smooth or, in the more general case, a uniformly rough surface at zero incidence in air at Mach numbers from zero to five are presented. The data are derived with the assumption that fully developed turbulent flow exists from the leading edge of the plate, which is considered the virtual origin. The two dimensional supersonic flow about sharp wedges, the axisymmetric flow over cylinders, and the axisymmetric flow over pointed cones are discussed with respect to the factors applied to the flat plate data. Author

N74-10009 Engineering Sciences Data Unit, London (England).
REYNOLDS NUMBER, SPEED OF SOUND, DYNAMIC VISCOSITY KINETIC PRESSURE AND TOTAL PRESSURE COEFFICIENT IN AIR
Aug. 1973 22 p refs Supersedes Aero-00.02.01, Aero-00.02.02, Aero-S-00.02.03, Aero-00.03.04 Sponsored by Roy Aeron. Soc.
(ESDU-73017; Aero-00.02.01; Aero-00.02.02; Aero-S.00.02.03; Aero-00.03.04) Copyright. Avail: Issuing Activity

The properties of the atmosphere up to altitudes of 32,000 feet were investigated. The specific subjects considered are: (1) the speed of sound, (2) the dynamic viscosity, (3) the kinetic pressure, the total pressure coefficient, and the Reynolds number. Mathematical models are developed to show the derivation of the data. Graphs of the various properties with respect to altitude variations are included. Author

N74-10010 Engineering Sciences Data Unit, London (England).
AERODYNAMIC CENTRE IN TWO DIMENSIONAL FLOW
Apr. 1973 3 p ref
(ESDU-Aircraft-08.01.05-Amend-A) Copyright. Avail: Issuing Activity

Graphs are presented for finding the theoretical aerodynamic center of an airfoil in incompressible inviscid two dimensional flow. An example for finding the center is included. F.O.S.

N74-10011 Engineering Sciences Data Unit, London (England).
INFORMATION ON THE USE OF DATA ITEMS IN THE SERIES BODIES 02.04
Jul. 1973 1 p
(ESDU-Bodies-02.04.00-Amend-A) Copyright. Avail: Issuing Activity

The development of data pertaining to aerodynamic coefficients for streamlined bodies at small angles of incidence is discussed. The subjects involved are: (1) profile drag, (2) surface friction drag, and (3) laminar boundary layer flow. The effects of waviness, skin joints, and dust contamination on the location of the transition point are described. Author

N74-10012 Engineering Sciences Data Unit, London (England).
SUBSONIC PERFORMANCE DATA FOR NACA TYPE SUBMERGED AIR INTAKES
Apr. 1973 2 p
(ESDU-66029) Copyright. Avail: Issuing Activity

The aerodynamic characteristics of submerged intakes are analyzed. The classification of the intakes according to planform geometry is explained. The performance of the submerged intakes is expressed in terms of the ram efficiency which is primarily dependent on the boundary layer conditions. The data are based on local sonic and supersonic conditions. Author

N74-10013# Aeronautical Research Inst. of Sweden, Stockholm.
COMPUTATION OF VORTEX MODELS FOR WINGS AT HIGH ANGLE OF ATTACK IN INCOMPRESSIBLE FLOW
Sven G. Hedman 1973 23 p refs
(FFA-AU-653) Avail: NTIS HC $3.25

The vortex lattice method is applied in the solution of the thin wing lifting problem. The strength of the horse shoe vortices and a set of trailing vortex definition points are computed. The flow is required to be tangential in a number of collocation points on the wing and on the trailing vortices. This is expressed in a system of equations. It is shown how the system can be solved in two ways. In the first the system is partitioned into two subsystems, one where the boundary conditions of the wing are used for the determination of the vortex strengths, and one where the boundary conditions of the free vortices determine the positions of the vortices. In the second method the whole system is solved simultaneously by means of Newton-Raphson's rule. Author

N74-10014*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EXPLORATORY INVESTIGATION AT MACH NUMBERS FROM 0.40 TO 0.95 OF THE EFFECTS OF JETS BLOWN OVER A WING
Lawrence E. Putnam Washington Nov. 1973 71 p refs
(NASA-TN-D-7367; L-9067) Avail: NTIS HC $3.50 CSCL 01A

An exploratory investigation has been made at Mach numbers from 0.40 to 0.95 to determine the effects on lift, drag, and pitching moment of blowing a jet exhaust over the upper surface of a 50 deg swept leading-edge wing. Also investigated were the effects of varying the longitudinal and vertical location of the nozzle exit on the induced effects of jet blowing. Author

N74-10015*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
EFFECT OF BLOCKAGE RATIO ON DRAG AND PRESSURE DISTRIBUTIONS FOR BODIES OF REVOLUTION AT TRANSONIC SPEEDS
Lana M. Couch and Cuyler W. Brooks, Jr. Washington Nov. 1973 111 p refs
(NASA-TN-D-7331; L-8449) Avail: NTIS HC $4.25 CSCL 01A

Experimental data were obtained in two wind tunnels for 13 models over a Mach number range from 0.70 to 1.02. Effects of increasing test-section blockage ratio in the transonic region near a Mach number of 1.0 included change in the shape of the drag curves, premature drag creep, delayed drag divergence, and a positive increment of pressures on the model afterbodies. Effects of wall interference were apparent in the data even for a change in blockage ratio from a very low 0.000343 to an even lower 0.000170. Therefore, models having values of blockage ratio of 0.0003 - an order of magnitude below the previously considered safe value of 0.0050 - had significant errors in the drag-coefficient values obtained at speeds near a Mach number of 1.0. Furthermore, the flow relief afforded by slots or perforations in test-section walls - designed according to previously accepted criteria for interference-free subsonic flow - does not appear to be sufficient to avoid significant interference of the walls with the model flow field for Mach numbers very close to 1.0. Author

N74-10016# National Center for Atmospheric Research, Boulder, Colo. Facilities Lab.
WIND TUNNEL AND FIELD INVESTIGATIONS OF SHAPES FOR BALLOON SHELTERS
Robert H. Meroney and Erich J. Plate Feb. 1973 61 p refs Sponsored by NSF
(NCAR-TN/EDD-82) Avail: NTIS HC $5.25 CSCL 01A

The results of a series of wind tunnel and field tests performed in support of a program to develop a balloon inflation and launch shelter are discussed. The study discusses scaling criteria for simulating a shelter; velocity, turbulence, and frequency spectra downwind of four basic shelter shapes; the effects of screen materials on a shelter's efficiency; and the influence of the presence of a simulated balloon upon the effectiveness of the shelter. Author

N74-10017*# National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICS: SPACE IN THE SEVENTIES
Dec. 1971 27 p Original contains color illustrations
(NASA-EP-85) Avail: NTIS HC $3.50 CSCL 01A

The aeronautical research activities of NASA during the 1970 time period are discussed. The four types of aeronautical

research are defined as: (1) proof of concept, (2) extension of the art, (3) future needs, and (4) problem solving. Photographs and illustrations of various research projects are presented. The procedures for conducting typical research projects are described. Author

N74-10018*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TRANSONIC FAN STAGE WITH WEIGHT FLOW PER UNIT ANNULUS AREA OF 178 KILOGRAMS PER SECOND PER SQUARE METER (6.5(LB/SEC)/(SQ FT))
Royce D. Moore, Donald C. Urasek, and George Kovich Washington Nov. 1973 91 p refs
(NASA-TM-X-2904; E-7081) Avail: NTIS HC $3.75 CSCL 01A

The overall and blade-element performances are presented over the stable flow operating range from 50 to 100 percent of design speed. Stage peak efficiency of 0.834 was obtained at a weight flow of 26.4 kg/sec (58.3 lb/sec) and a pressure ratio of 1.581. The stall margin for the stage was 7.5 percent based on weight flow and pressure ratio at stall and peak efficiency conditions. The rotor minimum losses were approximately equal to design except in the blade vibration damper region. Stator minimum losses were less than design except in the tip and damper regions. Author

N74-10019*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
THE EFFECTS OF LEADING-EDGE SERRATIONS ON REDUCING FLOW UNSTEADINESS ABOUT AIRFOILS, AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION Final Report
R. G. Schwind and H. J. Allen Washington NASA Nov. 1973 97 p refs
(Contract NAS2-6010)
(NASA-CR-2344) Avail: NTIS HC $3.75 CSCL 01A

High frequency surface pressure measurements were obtained from wind-tunnel tests over the Reynolds number range 1.2 times one million to 6.2 times one million on a rectangular wing of NACA 63-009 airfoil section. Measurements were also obtained with a wide selection of leading-edge serrations added to the basic airfoil. Under a two-dimensional laminar bubble very close to the leading edge of the basic airfoil there is a large apatial peak in rms pressure. Frequency analysis of the pressure signals in this region show a large, high-frequency energy peak which is interpreted as an oscillation in size and position of the bubble. The serrations divide the bubble into segments and reduce the peak rms pressures. A low Reynolds number flow visualization test on a hydrofoil in water was also conducted. A von Karman vortex street was found trailing from the rear of the foil. Its frequency is at a much lower Strouhal number than in the high Reynolds number experiment, and is related to the trailing-edge and boundary-layer thicknesses. Author

N74-10020*# Hamilton Standard, Windsor Locks, Conn.
NOISE AND WAKE STRUCTURE MEASUREMENTS IN A SUBSONIC TIP SPEED FAN Final Report
B. Magliozzi, D. B. Hanson, B. V. Johnson, and F. B. Metzger Washington NASA Nov. 1973 94 p refs
(Contract NAS1-11670)
(NASA-CR-2323) Avail: NTIS HC $3.75 CSCL 20D

The results of an experimental program are reported which show the effect of blade angle, tip speed, fan pressure ratio, and thrust on noise of a model fan of 0.457m (18 inches) diameter operating at subsonic tip speeds at pressure ratios between 1.06 and 1.15. The fan used in this study had 12 blades, 7 stator vanes, and a spacing between the rotor and stator of 1.85 blade chords. This fan was originally designed for aerodynamic testing and was considered a good performer. It was used in the noise test program as it incorporated features found to reduce noise in an earlier analytical parametric study. For a given pressure ratio the fan was shown to exhibit minimum noise at the blade angle and tip speed near that of maximum aerodynamic efficiency. Also, the noise level and spectrum character of this fan showed excellent correlation with scaled data of a similar larger diameter fan. Results of the program confirm the trends shown in the earlier analytical parametric study which showed that fan noise could be reduced for a given thrust and pressure ratio by increasing fan solidity, improving fan aerodynamic design, and operating the fan at an optimum subsonic tip speed. In addition to noise, the blade wake characteristics at the leading edge of the stator were measured in this program. At root and tip sections some difference between predicted and measured wakes was found. However comparisons between predicted and measured wakes at mid span locations was found to be good. Author

N74-10021*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME DESIGN CONSIDERATIONS FOR SUPERSONIC CRUISE MIXED COMPRESSION INLETS
David N. Bowditch 1973 20 p refs Presented at the Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA
(NASA-TM-X-71460; E-7756) Avail: NTIS HC $3.00 CSCL 01A

A mixed compression inlet designed for supersonic cruise has very demanding requirements for high total pressure recovery and low bleed and cowl drag. However, since the optimum inlet for supersonic cruise performance may have other undesirable characteristics, it is necessary to establish trade-offs between inlet performance and other inlet characteristics. Some of these trade-offs between the amount of internal compression, aerodynamic performance and angle-of-attack tolerance are reviewed. Techniques for analysis of boundary layer control and subsonic diffuser flow are discussed. Author

N74-10022*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TRANSONIC FAN STAGE WITH WEIGHT FLOW PER UNIT ANNULUS AREA OF 208 KILOGRAMS PER SECOND PER SQUARE METER (42.6 (LB/SEC)/SQ FT)
Donald C. Urasek, George Kovich, and Royce D. Moore Washington Nov. 1973 98 p refs
(NASA-TM-X-2903; E-7229) Avail: NTIS HC $3.75 CSCL 01A

Performance was obtained for a 50-cm-diameter compressor designed for a high weight flow per unit annulus area of 208 (kg/sec)/sq m. Peak efficiency values of 0.83 and 0.79 were obtained for the rotor and stage, respectively. The stall margin for the stage was 23 percent, based on equilvant weight flow and total-pressure ratio at peak efficiency and stall. Author

N74-10023# Cranfield Inst. of Technology (England). Coll. of Aeronautics and Aerodynamics.
AN INVESTIGATION OF A NONPLANAR VORTEX LATTICE METHOD FOR WING CALCULATIONS Progress Report
Y. L. Sinai and E. A. Boyd Jun. 1973 68 p refs
(Cranfield-Aero-17) Avail: NTIS HC $5.50

A non-planar vortex lattice method, its application to the subsonic problem of any number of complex planforms arbitrarily arranged in space, and some results of a Fortran 4 program which is based on this method are discussed. The program is applied to two rectangular planforms (aspect ratios of 4 and 6), a swept and tapered planform, an elliptic wing and two rectangular wings (both of aspect ratio 6) in tandem, and comparison is made with other lifting-surface results. Particular emphasis is placed on the results for the elliptic wing which can be compared with an exact potential flow solution. These results are used as a basis for a preliminary choice for the optimum layout of the lattice over the planform and for suggestions regarding future investigations in this context. Particular reference is made to the value of K (the vortex drag factor) for the elliptic wing and to the side-force acting on the tips of plane rectangular wings. Author

N74-10024*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR PREDICTING OFF-DESIGN PERFORMANCE OF CENTRIFUGAL COMPRESSORS
Michael R. Galvas Washington Nov. 1973 59 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-7487; E-7480) Avail: NTIS HC $3.50 CSCL 01A

A FORTRAN program for calculating the off-design performance of centrifugal compressors with channel diffusers is presented. Use of the program requires complete knowledge of the overall impeller and diffuser geometries. Individual losses are computed using analytical equations and empirical correlations which relate loss levels to velocity diagram characteristics and overall geometry. On a given speed line compressor performance is calculated for a range of inlet velocity levels. At flow rates between surge and choke, individual efficiency decrements, compressor overall efficiency, and compressor total pressure ratio are tabulated. An example case of performance comparison with a compressor built by a commercial engine manufacturer is presented to demonstrate the correlation with limited experimental data. Author

N74-10025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF INCREASED LEADING-EDGE THICKNESS ON PERFORMANCE OF A TRANSONIC ROTOR BLADE
Lonnie Reid and Donald C. Urasek Washington Nov. 1972 57 p refs
(NASA-TN-D-7489; E-7076) Avail: NTIS HC $3.50 CSCL 01A

A single-stage transonic compressor was tested with two rotor blade leading-edge configurations to investigate the effect of increased leading-edge thickness on the performance of a transonic blade row. The original rotor blade configuration was modified by cutting back the leading edge sufficiently to double the blade leading-edge thickness and thus the blade gap blockage in the tip region. At design speed this modification resulted in a decrease in rotor overall peak efficiency of four points. The major portion of this decrement in rotor overall peak efficiency was attributed to the flow conditions in the outer 30 percent of the blade span. At 70 and 90 percent of design speed, the modification had very little effect on rotor overall performance. Author

N74-10026*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF PREDICTED AND MEASURED LOW-SPEED PERFORMANCE OF TWO 51 CENTIMETER-DIAMETER INLETS AT INCIDENCE ANGLE
James A. Albers Washington Nov. 1973 41 p refs
(NASA-TM-X-2937; E-7546) Avail: NTIS HC $3.00 CSCL 01A

Theoretical and experimental internal flow characteristics of two 51-cm-diameter inlets are compared. Theoretical flow characteristics along the inlet surface were obtained from an axisymmetric potential flow and boundary layer analysis. The experimental data were obtained from low-speed tests of a high-bypass-ratio turbofan engine simulator. Comparisons between calculated internal surface pressure distributions and experimental data are presented for a free-system velocity of 45 m/sec and for incidence angles from 0 deg to 50 deg. Analysis of boundary layer separation on the inlet lip at incidence angle is the major emphasis of this report. Theoretical boundary layer shape factors, skin friction coefficients, and velocity profiles in the boundary layer are presented, along with the location of the transition region. Theoretical and experimental separation locations are also discussed. Author

N74-10027*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF TRANSONIC FAN STAGE WITH WEIGHT FLOW PER UNIT ANNULUS AREA OF 198 KILOGRAMS PER SECOND PER SQUARE METER (40.6(LB/SEC)/SQ FT)
George Kovich, Royce D. Moore, and Donald C. Urasek Washington Nov. 1973 92 p refs
(NASA-TM-X-2905; E-7205) Avail: NTIS HC $3.75 CSCL 01A

The overall and blade-element performance are presented for an air compressor stage designed to study the effect of weight flow per unit annulus area on efficiency and flow range. At the design speed of 424.8 m/sec the peak efficiency of 0.81 occurred at the design weight flow and a total pressure ratio of 1.56. Design pressure ratio and weight flow were 1.57 and 29.5 kg/sec (65.0 lb/sec), respectively. Stall margin at design speed was 19 percent based on the weight flow and pressure ratio at peak efficiency and at stall. Author

N74-10028*# Chrysler Corp., New Orleans, La. Data Management Services.
TRANSONIC AERODYNAMIC CHARACTERISTICS ASSOCIATED WITH VARIATIONS IN THE GEOMETRY OF THE FORWARD PORTION OF IRREGULAR PLANFORM WINGS
Bernard Spencer, Jr. (NASA. Langley Res. Center) and David R. Stone (NASA. Langley Res. Center) Sep. 1973 356 p refs
(Contract NAS9-13247)
(NASA-CR-128781; DMS-DR-2041) Avail: NTIS HC $20.00 CSCL 01A

The experimental aerodynamic characteristics of three basic wing planforms on a conceptual orbiter fuselage (designated the LO-100) have been obtained in the 8-Foot Transonic Pressure Tunnel. The study included variations in the forward portion (fillet) of each basic wing. Fillet sweeps to 78 deg were investigated while holding the spanwise intersection of the fillet and wing constant. The data were obtained at Mach numbers of 0.35 to 1.2 and at Reynolds number (depending on Mach number) of 1.9 million to 2.11 million per foot. The angle of attack was varied from about minus 2 deg to 22 deg at 0 deg of sideslip. Author

N74-10029*# Lockheed-Georgia Co., Marietta.
ADDITIONAL THREE-DIMENSIONAL BOUNDARY-LAYER COMPUTATIONS FOR A FINITE SWEPT WING
J. F. Nash, R. M. Scruggs, and W. A. Stevens [1972] 62 p refs
(Contract NAS1-12153)
(NASA-CR-132335) Avail: NTIS HC $5.25 CSCL 01A

Calculations have been made of the three-dimensional, compressible, turbulent boundary layer on the finite supercritical wing of the NASA modified F-8 transonic research airplane. The calculations were based on the wing pressure distribution measured in flight at M = 0.90, instead of on wind tunnel data at M = 0.50 and 0.99. Data on the boundary-layer thickness, displacement thickness, skin-friction components, and integrated streamwise skin friction are presented for points along the streamwise stations at which pressure measurements were made. Author

N74-10030*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A STUDY OF METHODS WHICH PREDICT SUPERSONIC FLOW FIELDS FROM BODY GEOMETRY, DISTANCE, AND MACH NUMBER
Robert J. Mack Washington Nov. 1973 25 p refs
(NASA-TN-D-7387; L-8940) Avail: NTIS HC $2.75 CSCL 01A

A study of seven methods for predicting flow-field pressure signatures from the parameters Mach number, body geometry, and field-path distance has been made. The methods included the method of characteristics, which served as a standard of comparison; a shock-capturing method; three Whitham theory methods; a modified characteristics method; and a bicharacteristics method. Results from each method were also compared with recently obtained wind-tunnel data for a cone-cylinder model at Mach numbers of 2.96 and 4.63 with ratios of radial distance to cone length of 2 and 5. The comparisons at a Mach number of 2.96 showed that signatures from all the methods correlated well with wind-tunnel data and with the signatures predicted by the method of characteristics. At a Mach number of 4.63, however, the agreement between the signatures obtained in the wind tunnel and those predicted by theory varied from good to poor, as did the agreement between the signatures obtained by the method of characteristics and the other six methods. It should be noted that these results and comparisons indicate pressure prediction capabilities only for the near-field flow about bodies of revolution. Author

N74-10031*# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
RESEARCH ON THE SONIC BOOM PROBLEM. PART 2: FLOW FIELD MEASUREMENT IN WIND TUNNEL AND

CALCULATION OF SECOND ORDER F-FUNCTION Final Report
M. Landahl, H. Soerensen, and L. Hilding Washington NASA Nov. 1973 111 p refs
(Grant NGR-52-120-001)
(NASA-CR-2340; FFA-AU-621-Pt-2) Avail: NTIS HC $4.25 CSCL 20D

An experimental investigation has been carried out in a wind tunnel to test some of the results of Landahl's second order theory. The slender models consisted of a parabolic spindle, tested at M = 3, and a wing body configuration, suggested by Ferri, and tested at M = 2.7. The theory indicates that shock position and strength at an arbitrary distance can be calculated by means of near field measurements. The results show that this method is an appropriate one for simple bodies and for bodies with complicated geometries as well. Author

N74-10032# Naval Ordnance Lab., White Oak, Md.
AN EMPIRICAL EQUATION FOR PREDICTION OF TRANSITION LOCATION ON CONES IN SUPER-OR HYPERSONIC FLIGHT
Neal Tetervin 14 Jun. 1973 28 p refs
(AD-765692; NOLTR-73-127) Avail: NTIS CSCL 16/3

An empirical equation has been developed for the prediction of transition location on blunt and sharp cones. The equation predicts the transition location fairly well for 48 ballistics range tests for cones without ablation and for 40 flight tests for cones with ablation ranging from zero to large. The equation is applicable for cones in supersonic or hypersonic flight. The experimental data cover a range of local Mach numbers at transition from 2.8 to 14.7 and a range of the ratio of local wall to local stream temperature at transition from .074 to 1.43.
Author (GRA)

N74-10033# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
TWO-DIMENSIONAL WIND TUNNEL TEST ON A VARIABLE-CAMBER AIRFOIL WITH DISTRIBUTED SUCTION BOUNDARY-LAYER CONTROL Final Report
L. J. Mertaugh, N. S. Kiran, and S. Dey May 1973 73 p refs
(Contract DAAJ02-67-C-0016; DA Proj. 1F1-62204-A-142)
(AD-766304; EIRS-ASE-73-2; USAAMRDL-TR-73-3) Avail: NTIS CSCL 01/1

The report presents the results of a test program that was intended to investigate possible improvements in the methods used to predict the suction distribution required to prevent separation of the turbulent boundary layer at high lift coefficients, and provide experimental data on a variable-camber airfoil with distributed-suction boundary-layer control. Two, 2-dimensional wind-tunnel models were tested, and test speeds between 56 and 131 feet per second were used. Model lift and moment data were obtained. (Modified author abstract) GRA

N74-10440 Institut Franco-Allemand de Recherches, St. Louis (France).
TRANSONIC FLOW AROUND SLENDER BODIES [TRANSSONISCHE UMSTROEMUNG SCHLANKER KOERPER]
Marc Giraud *In its* Papers on Ballistics and Phys. of Transience 1973 p 77-95 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N74-10034* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIGHTWEIGHT, VARIABLE SOLIDITY KNITTED PARACHUTE FABRIC Patent
Frederick R. Matthews, Jr. and Erskine C. White, inventors (to NASA) Issued 9 Oct. 1973 6 p Filed 23 Dec. 1971 Supersedes N72-21004 (10 - 12, p 1553)
(NASA-Case-LAR-10776-1; US-Patent-3,764,097; US-Patent-Appl-SN-211332; US-Patent-Class-244-145) Avail: US Patent Office CSCL 11E

A parachute fabric for aerodynamic decelerator applications is described. The fabric will permit deployment of the decelerator at high altitudes and low density conditions. The fabric consists of lightweight, highly open, circular knitted parachute fabric with ribbon-like yarns to assist in air deflection.
Official Gazette of the U.S. Patent Office

N74-10035 International Civil Aviation Organization, Montreal (Quebec).
AIRWORTHINESS COMMITTEE TENTH MEETING
1973 189 p Conf. Held at Montreal, 22 May - 8 Jun. 1973 (Doc-9065; Air-C-10) Copyright. Avail: Issuing Activity

The proceedings of an Airworthiness Committee meeting are presented. The committee is composed of representatives from various foreign nations and is concerned with improving the flight safety of all types of aircraft and operations. The subjects discussed are: (1) airworthiness policy, (2) aircraft flying qualities, (3) aircraft performance problems, (4) crash survival, and (5) structural problems involving gust criteria. Author

N74-10036# Joint Publications Research Service, Arlington, Va.
COMPUTATION OF THE AERODYNAMIC CHARACTERISTICS OF A RECTANGULAR WING WITH PLATES MOVING AT LOW SUBSONIC SPEED NEAR A SCREEN
S. D. Yermolenko, Yu. A. Rogozin, and G. V. Rogachev 24 Oct. 1973 11 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), no. 3, 1972 p 105-112
(JPRS-60353) Avail: NTIS HC $3.00 CSCL 01A

The computation results are discussed of the aerodynamic characteristics of a rectangular wing with plates moving at a low subsonic speed near a screen. Author

N74-10037*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE TESTS OF A HIGH-ASPECT-RATIO SLOT NOZZLE WITH VARIOUS V-GUTTER TARGET THRUST REVERSERS
James R. Stone and Orlando A. Gutierrez 1973 22 p refs Presented at 86th Meeting of the Acoustical Soc. of Am., Los Angeles, 30 Oct. - 2 Nov. 1973
(NASA-TM-X-71470; E-7771) Avail: NTIS HC $3.25 CSCL 20A

The results of experiments on the noise generated by a 1.33- by 91.4 cm slot nozzle with various V-gutter reversers, and some thrust measurements are presented. The experiments were conducted with near-ambient temperature jets at nozzle pressure ratios of 1.25 to 3.0, yielding jet velocities of about 190 to 400 m/sec. At pressure ratios of 2 or less, the reversers, in addition to being noisier than the nozzle alone, also had a more uniform directional distribution and more high-frequency noise. At pressure ratios above 2, the nozzle alone generated enough shock noise that the levels were about the same as for the reversers. The maximum overall sound pressure level and the effective overall sound power level both varied with the sixth power of jet velocity over the range tested. The data were scaled up to a size suitable for reversing the wing-flap slot nozzle flow of a 45 400-kg augmentor-wing-type airplane on the ground, yielding perceived noise levels well above 95 PNdB on a 152-m sideline. Author

N74-10038*# Linguistic Systems, Inc., Cambridge, Mass.
STUDY OF HEAVING MOTION IN AIR CUSHION VEHICLES
G. VandeSteen Washington NASA Nov. 1973 121 p refs Transl. into ENGLISH from "Etude du Mouvement de Pilonnement des Vehicules a Coussin d'Air" Brussels, NT 33, 1973 97 p
(Contract NASw-2482)
(NASA-TT-F-15106) Avail: NTIS HC $8.25 CSCL 01C

The behavior of three types of ground effect machines experiencing oscillations in vertical translation with no pitch, roll,

or yaw was studied. The configurations of the ground effect machines are described. It is shown that the two important movements in the problem are heaving and pitching, as yaw has virtually no effect of the performance of the vehicle. Preliminary tests showed that for all three types of vehicles, the transient state is in general an oscillating one, similar to a damped sinusoid. Author

N74-10039# Teer (James G.) and Co., College Station, Tex.
STUDIES OF THE EFFECTS OF SONIC BOOM ON BIRDS Final Report
James G. Teer and Joe C. Truett Sep. 1973 82 p refs
(Contract DOT-FA72WAI-238; DI-14-16-0001-5351-FR)
(FAA-RD-73-148) Avail: NTIS HC $6.25

A field study was carried out to try to discover if occurence of sonic booms created by overflying aircraft was adversely affecting reproduction of wild birds. Several measures of reproductive success in mourning doves, mockingbirds, cardinals, and lark sparrows were compared between a test area and a control area. The test area was subject to sonic booms occurring 2 or 3 times a week; the control area was essentially free from sonic boom disturbance. Some differences in various phases of reproductive success were found between the 2 areas. However, none of the comparisons indicated that the differences were caused by other than natural environmental factors. In the final analysis, the authors could find no evidence that sonic boom disturbance affected phases of bird reproduction studied in the program. Author

N74-10040# National Aviation Facilities Experimental Center, Atlantic City, N.J.
LIGHTNING EFFECTS ON GENERAL AVIATION AIRCRAFT Final Report, Jan. - Sep. 1972
J. A. Plumer Oct. 1973 57 p refs
(Contract DOT-FA72NA-656)
(FAA-NA-73-32(2); FAA-RD-73-99) Avail: NTIS HC $5.00

To determine the actual lightning vulnerability of typical light aircraft systems and components, and demonstrate the required vulnerability assessment techniques, analyses and laboratory tests were performed on several typical light aircraft and some of their systems and components. The engineering and laboratory evaluation of component or system vulnerability are described. Author

N74-10041# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: AIR IOWA, INCORPORATED, BEECH E18S, N310WA, DAVENPORT IOWA, 19 APR. 1973
3 Oct. 1973 23 p
(NTSB-AAR-73-18) Avail: NTIS HC $3.25

An aircraft accident involving the crash of a Beechcraft E18S aircraft during approach to the municipal airport at Davenport, Iowa on 19 April, 1973 is reported. The suspected cause of the accident was in-flight failure of the right wing from a preexisting fatigue crack in the lower spar cap of the wing. Author

N74-10042*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF EXHAUST NOZZLE CONFIGURATION ON AERODYNAMIC AND ACOUSTIC PERFORMANCE OF AN EXTERNALLY BLOWN FLAP SYSTEM WITH A QUIET 6:1 BYPASS RATIO ENGINE
N. E. Samanich, L. J. Heidelberg, and W. L. Jones 1973 32 p refs Presented at the Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; sponsored by AIAA and SAE
(NASA-TM-X-71466; E-7765) Avail: NTIS HC $3.75 CSCL 01C

A highly suppressed TF-34 engine was used to investigate engine and flap interaction noise associated with an externally blown flap STOL powered lift system. Noise, efficiency, and velocity decay characteristics of mixed and separate flow exhaust systems including convergent, co-annular, and lobed designs were determined with the engine operating alone. Noise data were then obtained for several of the exhaust configurations with the engine blowing a wing-flap segment. Noise for both the engine alone and the engine with blown flaps showed substantial differences for the various exhaust configurations tested. The differences in observed noise are related primarily to nozzle effective exhaust velocity, flap impingement velocity, and noise spectral shape. Author

N74-10043*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REFAN PROGRAM. PHASE 1: SUMMARY REPORT
Eldon W. Sams and Donald L. Bresnahan Oct. 1973 70 p refs
(NASA-TM-X-71456; E-7749) Avail: NTIS HC $5.50 CSCL 20A

The Refan Program is aimed at a large reduction in aircraft approach and takeoff noise in the vicinity of airports caused by the JT3D-powered 707's and DC-8's and the JT8D-powered 727's, 737's and DC-9's. These aircraft represent a major part of the existing commercial fleet. The noise reductions can be achieved by engine and nacelle modifications in the form of aircraft retrofit kits. Engine turbomachinery noise is reduced by replacing the current two-stage fan with a larger single-stage fan and by nacelle acoustic treatment. Jet noise is reduced by the reduction on jet velocity caused by additional turbine work extraction to drive the larger bypass fan. The predicted net effect of these modifications on installed performance is large noise reductions on both approach and takeoff, increased takeoff thrust, decreased takeoff field length, and maintained or improved aircraft range depending on the amount of acoustic treatment included. The Refan Program is being conducted in two phases under contracts with one engine and two airframe companies. Results of the Phase I work are summarized in this report which describes the refan nacelle configurations studied, the airplane modifications required to install the nacelles, and the resulting airplane performance and noise reductions predicted for all five aircraft. Author

N74-10044*# Aerospace Corp., El Segundo, Calif. Civil Programs Div.
AN ECONOMIC ASSESSMENT OF STOL AIRCRAFT POTENTIAL INCLUDING TERMINAL AREA ENVIRONMENTAL CONSIDERATIONS. VOLUME 2: APPENDICES
H. L. Solomon and S. Sokolsky Jul. 1973 233 p refs
(Contract NAS2-6473)
(NASA-CR-114605; ATR-73(7305)-1-Vol-2) Avail: NTIS HC $13.75 CSCL 01C

An economic assessment of short takeoff aircraft for short haul air transportation applications is presented. The economic viability and environmental compatibility of short takeoff aircraft service in high density areas were evaluated. The subjects discussed are: (1) aircraft configurations and performance, (2) airfield and terminal requirements, and (3) direct and indirect operating costs. Author

N74-10045*# Aerospace Corp., El Segundo, Calif. Civil Programs Div.
SMALL V/STOL AIRCRAFT ANALYSIS. VOLUME 2: APPENDICES
K. R. Smith, Jr. and F. W. Belina Jun. 1973 80 p refs
(Contract NAS2-6473)
(NASA-CR-114629; ATR-73(7302)-1-Vol-2) Avail: NTIS HC $6.00 CSCL 01C

A survey of general aviation activities in the United States was principally conducted through interviews with users, manufacturers, trade associations, and government organizations. A list of the organizations interviews is presented. The data became the basis for defining the current and future general aviation missions and performance. The economic characteristics of general aviation are examined. The desires of each organization regarding future aircraft characteristics are summarized. Author

N74-10046# National Aerospace Lab., Tokyo (Japan).
SIMULATION STUDY ON FLARE CONTROL SYSTEM BY OPTIMIZATION THEORY
Akira Watanabe and Yuso Horikawa Mar. 1973 27 p refs In JAPANESE; ENGLISH summary
(NAL-TR-312) Avail: NTIS HC $3.50

The simulation of a flare control system for an automatic aircraft landing system was conducted. Digital simulation analyses

were conducted for three systems. The simulation showed that an exponential flight path was applicable to the flare control system. The characteristics of the flight paths and the performance of the systems are discussed. Author

N74-10047# National Aerospace Lab., Tokyo (Japan).
SOME EFFECTS OF CENTER OF GRAVITY LOCATIONS OF ADDED MASS ON TRANSONIC FLUTTER CHARACTERISTICS OF LOW ASPECT RATIO AND SWEPTBACK THIN CANTILEVER WING
Eiichi Nakai, Toshiyuki Morita, Takao Kikuchi, Masatoshi Tokubo, and Minoru Takahashi Mar. 1973 15 p refs In JAPANESE; ENGLISH summary
(NAL-TR-314) Avail: NTIS HC $3.00

An experimental investigation of some effects of varied location of added mass at wing tip on transonic flutter characteristics of thin cantilever wings has been conducted in a transonic blowdown wind tunnel for flutter testing at Mach number between 0.819 and 1.192. The wings have sweptback angle of 42.5 at leading edge and of 10 at trailing edge, panel aspect ratio of 1.344 and taper ratio of 0.336. The flutter boundary expressed by the experimental flutter-velocity coefficient is characterized by having maximum values at around Mach number 1.03. The stable region expands by moving the C.G. location forward of the added mass. Author

N74-10048*# General Electric Co., Schenectady, N.Y. Specialty Fluidics Operation.
FLUIDIC EMERGENCY ROLL CONTROL SYSTEM Final Report
K. B. Haefner and T. S. Honda Mar. 1973 98 p
(Contract NAS2-5467)
(NASA-CR-114588) Avail: NTIS HC $7.00 CSCL 01C

A fluidic emergency roll control system for aircraft stabilization in the event of primary flight control failure was evaluated. The fluidic roll control units were designed to provide roll torque proportional to an electrical command as operated by two diametrically opposed thrust nozzles located in the wing tips. The control package consists of a solid propellant gas generator, two diametrically opposed vortex valve modulated thrust nozzles, and an electromagnetic torque motor. The procedures for the design, development, and performance testing of the system are described. Author

N74-10049*# General Electric Co., Cincinnati, Ohio. Advanced Engineering and Technology Programs Dept.
REMOTE LIFT FAN STUDY PROGRAM, VOLUME 4
May 1973 208 p refs
(Contract NAS3-14406)
(NASA-CR-121277; GE-AEG120-Vol-4) Avail: NTIS HC $12.50 CSCL 01C

A study program to select and conduct preliminary design of advanced technology lift fan systems to meet low noise goals of future V/STOL transport aircraft is discussed. This volume contains results of additional studies conducted to support the main preliminary design effort done under the Remote Lift Fan Study Program (Contract NAS3-14406) and a companion effort, the Integral Lift Fan Study (NAS3-14404). These results cover engine emission study, a review of existing engines for research aircraft application and support data for aircraft studies. Author

N74-10050# National Transportation Safety Board, Washington, D.C.
AIRCRAFT INCIDENT REPORT: EASTERN AIR LINES, INCORPORATED, BOEING 727-225, N8843E, TOLEDO, OHIO, 10 APRIL 1973
27 Sep. 1973 12 p
(NTSB-AAR-73-17) Avail: NTIS HC $3.00

An aircraft accident involving a Boeing 727 aircraft which struck some trees during an instrument approach to the Toledo Express Airport, Toledo, Ohio on 10 April, 1973 is reported. The aircraft successfully completed the landing after the tree strike. It was decided that the accident was caused by failure of the flight crew to adhere to established instrument approach procedures. Author

N74-10051*# Massachusetts Inst. of Tech., Cambridge.
MOTORLESS FLIGHT RESEARCH, 1972 Final Report
James L. Nash-Webber, ed. Washington NASA Nov. 1973 639 p refs
(Grant NGR-22-009-731)
(NASA-CR-2315) Avail: NTIS HC $12.75 CSCL 01C

The proceedings of a symposium on motorless flight research are presented. The subjects discussed are: (1) glider aerodynamic and design, (2) instrumentation, (3) structural concepts and materials, (4) soaring meteorology, (5) self-launching and ultralight sailplanes, and (6) performance testing. Author

N74-10052*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ACOUSTIC CHARACTERISTICS OF A LARGE-SCALE AUGMENTOR WING MODEL AT FORWARD SPEED
Michael D. Falarski and David G. Koenig Washington Nov. 1973 42 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-2940; A-4964) Avail: NTIS HC $3.00 CSCL 01A

The augmentor wing concept is being studied as one means of attaining short takeoff and landing (STOL) performance in turbofan powered aircraft. Because of the stringent noise requirements for STOL operation, the acoustics of the augmentor wing are undergoing extensive research. The results of a wind tunnel investigation of a large-scale swept augmentor model at forward speed are presented. The augmentor was not acoustically treated, although the compressor supplying the high pressure primary air was treated to allow the measurement of only the augmentor noise. Installing the augmentor flap and shroud on the slot primary nozzle caused the acoustic dependence on jet velocity to change from eighth power to sixth power. Deflecting the augmentor at constant power increased the perceived noise level in the forward quadrant. The effect of airspeed was small. A small aft shift in perceived noise directivity was experienced with no significant change in sound power. Sealing the lower augmentor slot at a flap deflection of 70 deg reduced the perceived noise level in the aft quadrant. The seal prevented noise from propagating through the slot. Author

N74-10053# European Space Research Organization, Paris (France).
INVESTIGATION AND APPLICATION OF TWO METHODS OF DETERMINING CO-EFFICIENTS OF TRANSFER FUNCTIONS OF LONGITUDINAL MOTION OF AIRCRAFT FROM MEASURED INPUT AND OUTPUT DATA
W. Boegel Sep. 1973 81 p refs Transl. into ENGLISH of Untersuch. und Anwend. zweier Verfahren zur Ermittlung der Flugzeug-Laengsbewegung aus gemessenen Verlaeufen von Ein- und Ausgaengen, DLR-FB-73-39, DFVLR, 31 Jan. 1973
(ESRO-TT-2; DLR-FB-73-39) Avail: NTIS HC $6.25

The basic principles and applications of the two methods to be investigated are briefly described. The first may be classified as an equation of motion method and the second as a response curve fitting method. Several variations of the first method are also given for special applications. This is followed by a description of the digital computer programs which were used to test the methods with digitally simulated input and output data. In addition to information on the propagation of random and systematic errors, the results provide guidelines for the design of the input function and the choice of parameters or methods in carrying out and evaluating tests. The application of the methods to flight measurements is illustrated with an example of measurements of the oscillation in the angle of incidence in the Piaggio P 149 D aircraft. Author

N74-10054# Naval Postgraduate School, Monterey, Calif.
A HELICOPTER FLIGHT PERFORMANCE SYSTEM USING AN LSI MICROPROCESSOR M.S. Thesis
Edwin Eugene Eloe and Richard Tazewell Scott, Jr. Jun. 1973 60 p refs
(AD-765680) Avail: NTIS CSCL 01/2

The report presents the development of a helicopter gross weight calculator. Required qualities for aircraft system components such as durability, reliability, and low weight are met using an LSI micro-processor. The prototype system which was developed weighs approximately four pounds and has approximate dimensions of 7 inches x 5 inches x 1/2 inches. The cost estimate for the system is less than $350. The calculator

solution is based on the solution technique currently being used by Naval aviators which is obtained from nomographs in the aircraft NATOPS manual. Minor modifications are required to make this system applicable to different helicopter types. A listing of the calculator program and a discussion of the prototype's operation are included. Author (GRA)

N74-10055# Naval Postgraduate School, Monterey, Calif.
LSO/PILOT INTERACTION SIMULATOR M.S. Thesis
Phillip Gary Stueck Jun. 1973 87 p refs
(AD-765686) Avail: NTIS CSCL 01/2

The thesis investigates the feasibility of simulating the Landing Signal Officer (LSO)/pilot interaction during the approach to a landing on an aircraft carrier. A simulator was created which duplicated the LSO's operational environment through the use of computer-generated visual displays. The LSO and the pilot were placed in this simulated carrier approach environment by (1) displaying a representation of the landing area plus a meatball and angle of attack information to the pilot while (2) simultaneously displaying the aircraft's approach to the LSO. Test results demonstrated the basic feasibility of simulating the LSO/pilot interaction and its application as a research tool in studying LSO models, wave-off techniques and landing techniques. Author (GRA)

N74-10056# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS). CH-54A T/R BLADE Interim Report, Jan. 1964 - Dec. 1972
Aug. 1973 27 p
(AD-766227; USAAVSCOM-TR-73-17) Avail: NTIS CSCL 01/3

The report describes a value engineering analysis of a helicopter rotor blade. Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N74-10057# Army Aviation Systems Command, St. Louis, Mo. Systems Performance Assessment Div.
MAJOR ITEM SPECIAL STUDY (MISS). CH-54A CLUTCH ASSEMBLY (APP) Interim Report, Jan. 1964 - Dec. 1972
Aug. 1973 24 p
(AD-766226; USAAVSCOM-TR-73-16) Avail: NTIS CSCL 01/3

The report describes a value engineering evaluation of helicopter rotor clutches. GRA

N74-10058# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIMULATING THE SYSTEM OF AUTOMATIC CORRECTION OF AIRCRAFT COORDINATES ON AN ANALOG COMPUTER
G. M. Burakov 16 Aug. 1973 11 p refs Transl. into ENGLISH from Vopr. Eksplutatsii i Primeneniya Vychislitelnoi Tekhn. v Grazhdanskoi Aviatsii (USSR), no. 207, 1971 p 110-117
(AD-765991; FTD-HT-23-731-73) Avail: NTIS CSCL 01/4

One of the ways of solving the problem of improving the accuracy in the realization of extreme motion of the aircraft's center of mass is the construction of a system of discrete automatic correction, which represents a closed system of the highest order with respect to the aircraft-autopilot circuit. In the terms of pulsed control of functionals this system is described by the equations of the generalized objects and laws governing the control. The selection of these laws establishes the control algorithm which is reduced to the shaping of the correcting pulse and realization of the effect. GRA

N74-10059# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
TEST PLAN REPORT FOR CATAPULT FATIGUE. TEST OF THE MODEL E-2 A/B AIRPLANE
Edward F. Kantz 25 Jun. 1973 20 p refs
(AD-765708; NADC-73139-30) Avail: NTIS CSCL 01/3

A laboratory fatigue test will be performed on an E-2 airframe to determine whether the airframe will sustain the effects of 3000 catapult launches without structural failure. Author (GRA)

N74-10060# Beta Industries, Inc., Dayton, Ohio.
CRASHWORTHY LANDING GEAR STUDY Final Report
Norman S. Phillips, Richard W. Carr, and Richard S. Scranton Apr. 1973 210 p refs
(Contract DAAJ02-70-C-0055; DA Proj. 1F1-62203-A-529)
(AD-765489; BII-214-6) Avail: NTIS CSCL 01/3

The purpose of the reported effort was twofold: to develop rotary-wing landing gear concepts and criteria which, when applied, would lessen the magnitude of crash forces transferred to occupiable areas of helicopters involved in severe yet survivable accidents; to use the concepts and criteria to design, fabricate, and test an experimental prototype skid landing gear system. Landing gear design criteria, crash criteria, energy-absorbing design criteria, and applicable specifications were collected and analyzed to establish the state of the art in the landing gear design and energy absorber design. Once this was accomplished, the data were used to develop preliminary design criteria and concepts for three classes of rotary-wing aircraft. The concepts were selected to be compatible with combined loads and various attitudes. (Modified author abstract) GRA

N74-10061# Texas A&M Univ., College Station. Dept. of Aerospace Engineering.
RESEARCH ON AIRCRAFT DYNAMICS FOR SUBSONIC FLIGHT Final Report, 1 Sep. 1968 - 31 May 1973
William P. Jones Jul. 1973 13 p refs
(Contract DAHC04-69-C-0015)
(AD-765657; AROD-T-5-8-E) Avail: NTIS CSCL 01/3

The report is submitted as a collection of abstracts of papers published by the scientific personnel of the aircraft dynamics group of Texas A and M University. A list of invited presentations is also included. GRA

N74-10062# Naval Postgraduate School, Monterey, Calif.
SOME PERFORMANCE CHARACTERISTICS OF THE BELL 100 TON SURFACE EFFECT SHIP M.S. Thesis
Lonnie Francis Cagle Jun. 1973 151 p refs
(AD-765689) Avail: NTIS CSCL 13/10

A computer program for simulating the performance of the 100-B surface effect ship is used to study the longitudinal motions of the ship under various wave conditions. An investigation into the effect that waves have on bow seal, stern seal, and plenum pressures is conducted. The relationship between the different pressures and their associated requirements of input air from the fans is studied. It is concluded that the computer program is limited to a certain range of speeds. The concept of the ship capturing air to reduce drag and increase its speed is questionable due to the rapid replenishment of air required to keep the ship riding on its bubble of air. (Modified author abstract) GRA

N74-10063# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
INVESTIGATION OF THE SUCTION SYSTEM AND BOUNDARY-LAYER CHARACTERISTICS ON A HIGH-LIFT, BLC L-19 TEST AIRCRAFT Final Report
L. J. Mertaugh and S. Burt May 1973 58 p refs
(Contract DAAJ02-67-C-0016; DA Proj. 1F1-62204-A-142)
(AD-766305; AASE-72-70; USAAMRDL-TR-73-2) Avail: NTIS CSCL 01/3

The report presents the results of a test program which was intended to document the boundary-layer control system characteristics of the high-lift L-19 aircraft. This aircraft incorporates a distributed-suction, turbulent-boundary-layer control system which allows trimmed lift coefficients of 4.8 to be developed. In addition to presenting the description of the suction hole distribution and computed values of the suction

velocity distribution, comparisons are made between the measured boundary-layer characteristics and one empirical, turbulent-boundary-layer profile description. The large influence of suction velocity on the wall shear stress is shown through the use of the momentum integral equation. Author (GRA)

N74-10064# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
VIBRATION EFFECTS ON HELICOPTER RELIABILITY AND MAINTAINABILITY Final Report
Angelo C. Veca Apr. 1973 123 p refs
(Contract DAAJ02-71-C-0037; DA Proj. 1F1-63204-D-38B)
(AD-766307; SER-611567USAAMRDL-TR-73-11) Avail: NTIS CSCL 01/3

Differences in reliability and maintainability data were examined on two groups of USAF H-3 helicopters with distinctly different vibration characteristics. One H-3 helicopter group was equipped with the rotor-mounted vibration adsorber, a device which reduces helicopter vibration induced by the rotor, and a second aircraft group did not have the absorber. The aircraft were alike in all other respects. The analyses performed on these data show a significant reduction in the failure rate and direct maintenance for the H-3 helicopters with absorbers and with reduced vibration levels. Correspondingly, life-cycle costs show a significant reduction of approximately 10% for the overall aircraft. At the subsystem and component levels, the same reductions are shown in almost every case with the exception of certain navigation and avionics components. (Modified author abstract) GRA

N74-10065# Air Force Weapons Lab., Kirtland AFB, N.Mex.
COCKPIT AIR FILTRATION REQUIREMENTS OF THE B-1 IN A NUCLEAR DUST ENVIRONMENT Technical Report, Jul. 1972 - Apr. 1973
Rayford P. Patrick, William A. Yingling, and George D. Arnett Jul. 1973 134 p refs
(AF Proj. 8809)
(AD-766711; AFWL-TR-73-83) Avail: NTIS CSCL 01/3

Results are presented which will aid in determining cockpit filtration requirements for the B-1 environmental control system when the B-1 penetrates radioactive dust clouds generated by surface detonations of nuclear weapons. The ionizing doses accumulated from being surrounded by the radiating cloud and the dust mass and associated ionizing doses from dust trapped in the filter and in the cockpit are presented. A technique for determining the filter point design conditions is discussed. Representative candidate filters are investigated, and an optimum filter is selected from the candidates. The evaluation techniques presented here may be used to investigate the adequacy of any proposed filter. Author (GRA)

N74-10066# Naval Postgraduate School, Monterey, Calif.
AIRCRAFT FUEL TANK ENTRY WALL-PROJECTILE INTERACTION STUDIES M.S. Thesis
Kenneth Scott Bates, Jr. Jun. 1973 55 p refs
(AD-765667) Avail: NTIS CSCL 01/3

Hydraulic ram is the physical production of pressure wave wall loadings due to projectile penetration and their effect on a fuel cell. Facilities were designed and testing conducted in preparation for investigation of the hydraulic ram phenomenon. A ballistic range was designed that yielded projectile velocity and flight attitude information before and after wall penetration. Wall specimens of a single thickness were impacted by a range of projectile sizes, weights, shapes, and velocities. This yielded the energy absorbed by the wall without fluid damping.
Author (GRA)

N74-10067# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYMMETRICAL EIGEN FORMS OF THE VIBRATIONS OF A SUPPORTING SURFACE AND OF AN ELASTIC FUSELAGE
Z. I. Burman and K. M. Shaidukov 29 Jan. 1973 19 p refs Transl. into ENGLISH from Issled. po Plastin i Obolochek (Kazan), no. 6, 1970 p 656-665
(AF Proj. 1369)
(AD-756285; FTD-HT-23-1815-72) Avail: NTIS CSCL 01/3

The report discusses a scheme for calculating the frequencies and forms of symmetrical vibrations of two crossed beams, one of which is exposed to bending torsional vibrations (a wing) while the second, only bending ones (a fuselage). The method of collocations is applied by using integral matrixes.
Author (GRA)

N74-10068# Clemson Univ., S.C. Dept. of Zoology.
RADAR TECHNIQUES FOR AIR FORCE APPLICATIONS IN AVOIDANCE OF BIRD-AIRCRAFT COLLISIONS AND IMPROVEMENT OF FLIGHT SAFETY Interim Technical Report
Sidney A. Gauthreaux, Jr. Dec. 1972 7 p refs
(Grant AF-AFOSR-1974-71; AF Proj. 9777)
(AD-754981; AFOSR-73-0030TR) Avail: NTIS CSCL 01/2

During the year three major objectives were accomplished: an evaluation of airborne radar systems for possible detection of birds aloft, an evaluation of the FAA airport surveillance radar (ASR-4) for monitoring bird movements in the vicinity of airports, and an evaluation of the precision approach radar (PAR) or ground control approach (GCA) radars for monitoring bird movements through airport landing corridors. The precision approach radar or ground control approach radar along with the airport surveillance radar were found to provide all the necessary data to avoid bird/aircrarft collisions. Furthermore, the flight controllers are in contact with the pilots and can warn them of dangerous concentrations of birds in their flight paths.
Author (GRA)

N74-10069# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Instrumentation Papers.
LAUNCHING OF SMALL INFLATED BALLOONS FROM CARGO AIRCRAFT
James C. Payne, Edward Young, and Catherine Rice 20 Apr. 1973 23 p refs
(AF Proj. 6665)
(AD-766428; AFCRL-TR-73-0276; AFCRL-IP-187) Avail: NTIS CSCL 01/3

A simple, inexpensive method has been developed for air-launching constant-level plastic balloons in rapid succession from a transport-type aircraft. The entire launch system is palletized upon one 24 ft-modular airdrop platform; no alterations to the aircraft are needed. The balloon, encased in a nylon bag, is inflated inside the aircraft, and extracted by parachute. The bag then falls away, releasing the balloon and payload. Four regular crew members can inflate and launch several 8-ft diam, polyethylene balloons at 10-min intervals from a C-130 aircraft flying at speeds up to 130 knots and at altitudes up to 10,000 feet. Author (GRA)

N74-10070# Goodyear Aerospace Corp., Akron, Ohio.
STABILITY AND DYNAMIC BEHAVIOR OF TWO TETHERED BALLOON SYSTEMS Final Report, 1 Mar. 1972 - 30 May 1973
George R. Doyle, Jr., Jerome J. Vorachek, and Donald B. Block 30 Jun. 1973 99 p refs
(Contract F19628-72-C-0219; AF Proj. 6665)
(AD-766439; GER-15960; AFCRL-TR-73-0396) Avail: NTIS CSCL 01/3

The stability characteristics and dynamic motions of a tethered balloon are of interest in determining design criteria under which safe operating conditions are achievable. An analytical investigation was conducted for two tethered barrage balloons using two separate mathematical tools. The balloon motion is assumed to be uncoupled into longitudinal and lateral modes of motion. The equilibrium stability characteristics of both modes of motion are determined by solving for the complex roots of the characteristic equations. The dynamics of the motion, under the influences of wind gust or initial displacements, are found by numerically integrating the equations of motion on a digital computer. The effects of different tether lengths, payload weights and wind conditions are considered. It was found that the stability analysis was able to accurately determine the frequencies of oscillation and the mode shapes as displayed in the dynamic results. In general, the most significant result is the reduction of stability in both the longitudinal and lateral degrees of freedom as the tether length is shortened. Author (GRA)

N74-10071# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
OPTIMAL INCOMPLETE FEEDBACK CONTROL OF LINEAR STOCHASTIC SYSTEMS Final Report, Jul. 1971 - Feb. 1973
Robert E. Heath, II Jun. 1973 226 p refs
(AF Proj. 8219)
(AD-766440; AFFDL-TR-73-36) Avail: NTIS CSCL 01/3

The problem of incomplete feedback control of stochastic linear systems is considered. The system is modeled by an uncertain parameter linear differential equation driven by Gaussian white noise and an incomplete observation which is a linear transformation of the states. The optimal control is the linear transformation of the observation which minimizes the expected value of a quadratic performance index. For both finite and infinite time problems, necessary conditions that the optimal control law must satisfy are derived. Time-varying and constant gains are considered for the finite-time problem. For the infinite-time problem only time-invariant gains are considered. The gradient derived for the infinite-time problem is applied to a flight control design problem. This problem concerns finding feedback gains to improve the lateral handling qualities of an F4 aircraft at two different flight conditions. The resulting control laws give quite adequate aircraft handling qualities for the aircraft at both flight conditions. Author (GRA)

N74-10072# Naval Ship Research and Development Center, Bethesda, Md.
RESPONSE PREDICTIONS OF HELICOPTER LANDING PLATFORM FOR THE USS BELKNAP (DLG-26) AND USS GARCIA (DE-1040)-CLASS DESTROYERS
Susan Lee Bales, William G. Meyers, and Grant A. Rossignol Jul. 1973 102 p refs
(AD-766450; NSRDC-3868) Avail: NTIS CSCL 01/2

Motion-response predictions of the helicopter landing platform for the USS BELKNAP (DLG-26) and USS GARCIA (DE-1040)-Class destroyers are presented. Predictions have been obtained by a computer-implemented procedure, which calculates response statistics at an arbitrary point on a ship in long-crested, irregular seas. The procedure is based on ship-motion theories in the state of the art. Results are presented for several ship speeds, states of sea, and ship headings--ranging from head to following waves. Existing envelopes of helicopter operations are discussed, and suggestions have been made, based upon the results of this study, for the listed new operational envelopes in higher states of seas: responses other than roll, e.g., vertical response at the landing platform, must be considered; quartering sea landings may be safer than bow sea landings; and to increase safety of operations, BELKNAP should be stabilized in roll. Author (GRA)

N74-10073# Avco Lycoming Div., Stratford, Conn.
SPRING OVERRIDING AIRCRAFT CLUTCH Final Report
P. Lynwander, A. G. Meyer, and S. Chachakis May 1973 151 p refs
(Contract DAAJ02-71-C-0035)
(AD-766309; TR-105-7-12; USAAMRDL-TR-73-17) Avail: NTIS CSCL 21/5

The purpose of this program was to investigate the performance of high-speed overriding spring clutch assemblies for use in a multiengine helicopter application. The design operating conditions were 3,570 inch-pounds torque transmitted at 26,500 rpm. Two clutch configurations were evaluated. An extensive test program was conducted as follows: Full-speed dynamic clutch override test; differential speed dynamic clutch override test; dynamic engagement test; static cyclic torque fatigue test; and static overload test. GRA

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N74-10074 Michigan Univ., Ann Arbor.
EXPERIMENTAL DETERMINATION OF DYNAMIC CHARACTERISTICS OF HYDROGEN OXYGEN FUEL CELL SYSTEMS Ph.D. Thesis
Bernard Ren Hao 1972 129 p
Avail: Univ. Microfilms Order No. 73-11307

Dynamic characteristics of aqueous electrolyte hydrogen-oxygen fuel cells were investigated at various cell temperatures, electrolyte concentrations, electrode spacings, and types of electrodes. An electrical circuit was employed as a mathematical model in correlating the dynamic response of the test cell to the related system parameters. A RC electrical circuit which included an ideal voltage source was proposed as the mathematical model for the fuel cell systems, and the circuit components were determined experimentally. The ideal voltage source in the equivalent network was determined by the open circuit voltage of the test fuel cell. The internal resistance of the test cell was determined by a galvanostatic method. The measured fuel cell internal resistance was found to be independent of the fuel cell load current and frequency. Dissert. Abstr.

N74-10075*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
MASS TRANSFER IN FUEL CELLS Semiannual Report, 1 Sep. 1972 - 28 Feb. 1973
Robert D. Walker, Jr. 26 Sep. 1973 50 p refs
(Grant NGR-10-005-022)
(NASA-CR-134519; SAR-15) Avail: NTIS HC $4.50 CSCL 10A

Results of experiments on electron microscopy of fuel cell components, thermal decomposition of Teflon by thermogravimetry, surface area and pore size distribution measurements, water transport in fuel cells, and surface tension of KOH solutions are described. Author

N74-10076# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
AN EVALUATION OF THE STRATIFIED CHARGE ENGINE (SCE) CONCEPT
L. Bogdan, H. T. McAdams, and D. J. Schuring Jan. 1972 209 p refs
(Contract EPA-68-04-0040)
(APTD-1356) Avail: NTIS HC $12.50 CSCL 10A

Preliminary studies are presented aimed at establishing a rational basis for the evaluation of the stratified charge engine as a low-emission power plant for light duty vehicle applications. A description of the salient engineering features of the stratified charge engine is included together with statistical analyses of the limited exhaust emissions data that are available on vehicles equipped with hand-built experimental engines. For purposes of augmenting this limited data base and for the purposes of comparison and analogy, statistical analyses of pertinent emissions data obtained for conventional-type automobile engines are also presented. To provide essential but missing data, the rationale for and the details of an experiment design for presently available engine/vehicle units are presented. New hardware requirements are also identified. Author

N74-10077*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ARRAY EXPERIMENTS ON THE SPHINX SATELLITE
N. John Stevens 1973 10 p refs Presented at the 10th Photovoltaic Specialists Conf., Palo Alto, Calif., 13-15 Nov. 1973; sponsored by IEEE
(NASA-TM-X-71458; E-7752) Avail: NTIS HC $3.00 CSCL 10A

The Space Plasma, High Voltage Interaction Experiment (SPHINX) is the name given to an auxiliary payload satellite scheduled to be launched in January 1974. The principal experiments carried on this satellite are specifically designed to obtain the engineering data on the interaction of high voltage systems with the space plasma. The classes of experiments are solar array segments, insulators, insulators with pin holes and conductors. The satellite is also carrying experiments to obtain flight data on three new solar array configurations; the edge illuminated-multijunction cells, the Teflon encased cells and the violet cells. Author

N74-10078*# Gould, Inc., Mendota Heights, Minn.
FABRICATION AND TESTING OF NEGATIVE-LIMITED SEALED NICKEL-CADMIUM CELLS Quarterly Report, 1 Jul. - 30 Sep. 1973
E. Luksha and K. C. Kohl 10 Oct. 1973 15 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953680)
(NASA-CR-135981; Rept-732-015-1) Avail: NTIS HC $3.00 CSCL 10C

The design, construction, and testing of 100,20Ah and 100,3Ah negative-limited sealed cells are reported. The required physical dimensions of the hardware and components necessary to produce 20 and 3 Ah cells were established. The stainless steel cans and covers have been ordered. The covers contain two ceramic seals. The fabrication of electrodes was started. About 55% (879 electrodes) of the required cadmium electrodes has been prepared. About 44% of the porous nickel substrates (plaques) required for the preparation of the nickel oxide electrodes has been completed. Author

N74-10079# Auburn Univ., Ala. Engineering Experiment Station.
LOW RIPPLE KLYSTRON POWER SUPPLY FOR EXPERIMENTAL ARRAY RADAR TRANSMITTER Final Report, 2 Jun. 1971 - 31 May 1973
William P. Albritton and Martial A. Honnell Jun. 1973 24 p (Contract DAAH01-71-C-1247)
(AD-765512) Avail: NTIS CSCL 10/2

A solid state Klystron power supply with ripple components of less than 1.3 microvolts at 1100 volts dc is described. Virtual elimination of 60-Hz related ripple is achieved by converting the 60-hertz power to dc which powers a hybrid push-pull amplifier with good common-mode rejection. The amplifier is driven by a 5-Kilohertz sinusoidal signal which may be phase locked with the radar pulse repetition frequency. The amplifier output signal drives transformers whose output voltages are rectified, regulated and filtered to yield low-ripple dc outputs. When phase locked, the low residual ripple is synchronous with the radar pulse, thus producing a minimum of system interference. The report is divided into two parts: the first part discussed technical problems encountered in the development of the power supply. (Modified author abstract) GRA

N74-10080# Army Foreign Science and Technology Center, Charlottesville, Va.
STATE OF DEVELOPMENTS AND RESEARCH PROBLEM ON THE SWITCHING OF SILICON GERMANIUM ALLOY THERMOELECTRIC ELEMENTS
L. L. Silin 30 Jul. 1973 15 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 2, 1971 p 116-125
(AD-765845; FSTC-HT-23-2026-72) Avail: NTIS CSCL 10/2

The article reviews the development of thermoelectric generators made with silicon germanium alloy thermoelements. GRA

N74-10081# Solar, San Diego, Calif.
THERMAL/PERFORMANCE EVALUATION OF THE 10 KW DIRECT CURRENT TURBO-RECTIFIER SET Final Technical Report, Jan. - Oct. 1972
J. S. Todd Nov. 1972 38 p
(Contract DAAK02-72-C-0205)
(AD-765505; ER-2422-F) Avail: NTIS CSCL 10/2

The report details the thermal and performance limitations of a segmented 10 kw Direct Current Turbo-Rectifier Set. Cooling air flow requirements for oil cooling and the rectifier assembly were experimentally determined. Testing was done at both ambient and hot day conditions. Author (GRA)

N74-10082# Rocketdyne, Canoga Park, Calif.
INVESTIGATION OF CHEMICAL APU APPLICATION FOR SMALL GROUND POWER SOURCES
James N. Ellis and Hartley E. Barber Jun. 1973 95 p refs (Contract DAAK02-72-C-0424)
(AD-765724; R-9284) Avail: NTIS CSCL 10/2

The Chemical APU (CAPU) turboalternator assembly was tested to determine its suitability for application to advanced Army Ground Power Systems. A major test objective was that of determining the allowable continuous power rating for the alternator as a function of rotative speed. Test speeds up to 120,000 rpm in 30,000 rpm increments were evaluated. A nitrogen test rig was used as a drive which invalidated turbine data. The tests show the alternator to be suitable for use in an advanced ground unit operating on a Brayton cycle to produce 3.5 kw at 140,000 rpm. The turbine should be redesigned for gas turbine flow conditions. A Rankine cycle system could use the turboalternator in its present design at a reduced speed (80,000 rpm) to produce 3.2 kw continuous power. Author (GRA)

N74-10083# Pratt and Whitney Aircraft, South Windsor, Conn. Engineering Facility.
STUDY OF FUEL CELL SYSTEM FOR POWERED BALLOON Final Report, 5 Feb. - 4 Jun. 1973
Lawrence M. Handley Sep. 1973 54 p
(Contract F19628-73-C-0139; AF Proj. 6665)
(AD-766253; PWA-4792; AFCRL-TR-73-0447) Avail: NTIS CSCL 10/2

A four-month study was conducted to determine the most economical use of these powerplants for a powered balloon system designated POBAL-S. The fuel cell powerplant selected for this application is an existing model, the PC17A-3, tailored to deliver 2.5 kilowatts at 30 volts d.c. continuously for seven days. In addition to the powerplant itself, the system would contain cryogenic tanks for the 39 pounds of hydrogen and 306 pounds of oxygen used by the fuel cell, a fabric bag for storing the 42 gallons of product water (to maintain constant buoyancy), and a 48-inch-wide-by-88-inch-long aluminum radiator to reject waste heat at 4000 Btu per hour. When loaded with reactants, the power system weighs 707 pounds, equivalent to an energy density of 600 watt-hours per pound. The power system would be mounted on a platform with the payload and the balloon housekeeping equipment to facilitate recovery by parachute. The platform protects everything except the radiator against landing shock, enabling the equipment to be reused for as many as 25 missions. Ground equipment for servicing the reactant tanks is available commercially. (Modified author abstract) GRA

N74-10084# Army Foreign Science and Technology Center, Charlottesville, Va.
POSSIBILITY OF COMMUTATING THERMOELECTRIC BATTERIES WITH THE AID OF MERCURY AMALGAM
Yu. N. Malevskii 9 Dec. 1972 7 p refs Transl. into ENGLISH from Geliotekhnika, Akad. Nauk Uz. SSR (Jashkent), no. 2, 1971 p 22-25
(AD-756068; FSTC-HT-23-1275-72) Avail: NTIS CSCL 10/2

One of the serious difficulties in the technology of preparation of thermoelectric energy converters is the commutation of thermoelement's branches which would secure a sufficient mechanical strength and low ohmic resistance contacts between current conducting bars and semiconductor materials of the thermoelement. Elimination of the commutation contact resistances is one of the most important problems in the design of thermoelements. Author (GRA)

N74-10085# Energy Research Corp., Bethel, Conn.
ELECTROLYTE FOR HYDROCARBON AIR FUEL CELLS Semiannual Technical Report, 7 Nov. 1972 - 7 Apr. 1973
Ralph N. Camp and Bernard S. Baker Jul. 1973 34 p refs (Contract DAAK02-73-C-0084; DA Proj. 1T0-61102-A-34A)
(AD-766313; ERC-00845) Avail: NTIS CSCL 10/2

Several acids were tested for use with direct hydrocarbon fuel cell electrolytes. Complete fuel cells of the matrix and free electrolyte type were used as test vehicles. The performance of cells possessing H_3PO_4 electrolyte served as a baseline. Only one, tetrafluoroethanedisulfonic acid synthesized at Energy Research Corporation was shown to be superior to phosphoric acid for direct propane oxidation of elevated temperature. Author (GRA)

N74-10086# Energy Research Corp., Bethel, Conn.
MATRICES FOR H_3PO_4 FUEL CELLS Final Report
Ralph N. Camp and Bernard S. Baker Aug. 1973 49 p refs (Contract DAAK02-72-C-0247; DA Proj. 1T6-62705-A-012)
(AD-766312; ERC-0959F) Avail: NTIS CSCL 10/2

Matrices to contain 150C phosphoric acid were perfected.

These matrices contain an organic fibre, Kynol, and a thermo-setting binder of similar chemical structure, Resinox. In addition Ta2O5 is added to improve the wetting characteristics. The matrices can be produced in uniform, large sheets. Anodes for the oxidation of hydrogen contaminated with carbon monoxide in H3PO4 were also explored. Using supported catalyst techniques, CO tolerant anodes contain .8 mg/sq cm of a mixture of platinum and ruthenium performed at better than .6V at 100mA/sq cm current density for a period in excess of 500 hours. Author (GRA)

N74-10240* Lockheed Missiles and Space Co., Sunnyvale, Calif.
TESTING FOR THERMAL FATIGUE FAILURES IN SOLAR ARRAYS
G. J. Antonides *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 99-101 (For availability see N74-10232 01-11)
CSCL 10A

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N74-10087*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 117, JULY 1973
Jul. 1973 103 p refs
(NASA-SP-7011(117)) Avail: NTIS HC $4.25 CSCL 06E

This special bibliography lists 353 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1973. Author

N74-10088*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 118, AUGUST 1973
Aug. 1973 102 p refs
(NASA-SP-7011(118)) Avail: NTIS HC $4.25 CSCL 06E

This special bibliography lists 338 reports, articles, and other documents introduced into the NASA scientific and technical information system in July 1973. Author

N74-10089*# Stanford Univ., Calif. School of Medicine.
SLEEP MECHANISMS: SLEEP DEPRIVATION AND DETECTION OF CHANGING LEVELS OF CONSCIOUSNESS Final Report
William C. Dement and Jack D. Barchas [1972] 5 p
(Grant NGR-05-020-576)
(NASA-CR-136023) Avail: NTIS HC $3.00 CSCL 06S

An attempt was made to obtain information relevant to assessing the need to sleep and make up for lost sleep. Physiological and behavioral parameters were used as measuring parameters. Sleep deprivation in a restricted environment, derivation of data relevant to determining sleepiness from EEG, and the development of the Sanford Sleepiness Scale were discussed. E.H.W.

N74-10090*# California Univ., Berkeley. White Mountain Research Station.
PHYSIOLOGICAL RESPONSES TO ENVIRONMENTAL FACTORS RELATED TO SPACE FLIGHT Semiannual Status Report, 1 Feb. -31 Jul. 1973
Nello Pace 31 Jul. 1973 43 p
(Grant NGL-05-003-024)
(NASA-CR-135946; Rept-23) Avail: NTIS HC $4.25 CSCL 06P

Physiological base line data are established, and physiological procedures and instrumentation necessary for the automatic measurement of hemodynamic and metabolic parameters during prolonged periods of weightlessness are developed. Author

N74-10091*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EVALUATION OF POSITIVE G SUB Z TOLERANCE FOLLOWING SIMULATED WEIGHTLESSNESS (BEDREST)
Lester B. Jacobson (PHS Hospital, San Francisco), Kenneth H. Hyatt (PHS Hospital, San Francisco), Robert W. Sullivan (PHS Hospital, San Francisco), Stephen A. Cantor (PHS Hospital, San Francisco), Harold Sandler (PHS Hospital, San Francisco), Salvadore A. Rositano, and Ronald Mancini Aug. 1973 96 p refs Prepared in cooperation with PHS Hospital, San Francisco
(NASA-TM-X-62311) Avail: NTIS HC $7.00 CSCL 06S

The magnitude of physiologic changes which are known to occur in human subjects exposed to varying levels of + G sub Z acceleration following bed rest simulation of weightlessness was studied. Bed rest effects were documented by fluid and electrolyte balance studies, maximal exercise capability, 70 deg passive tilt and lower body negative pressure tests and the ability to endure randomly prescribed acceleration profiles of +2G sub Z, +3G sub Z, and +4G sub Z. Six healthy male volunteers were studied during two weeks of bed rest after adequate control observations, followed by two weeks of recovery, followed by a second two-week period of bed rest at which time an Air Force cutaway anti-G suit was used to determine its effectiveness as a countermeasure for observed cardiovascular changes during acceleration. Results showed uniform and significant changes in all measured parameters as a consequence of bed rest including a reduced ability to tolerate +G sub Z acceleration. The use of anti-G suits significantly improved subject tolerance to all G exposures and returned measured parameters such as heart rate and blood pressure towards or to pre-bed-rest (control) values in four of the six cases. Author

N74-10092*# Minnesota Univ., Minneapolis. Space Science Center.
ENVIRONMENTAL MICROBIOLOGY AS RELATED TO PLANETARY QUARANTINE
Irving J. Pflug Jun. 1972 81 p refs
(Grant NGL-24-005-160)
(NASA-CR-135980; SAPR-8) Avail: NTIS HC $6.25 CSCL 06M

The survival of Bacillus subtilis var. niger spores suspended in solutions of sucrose and glycerol at calculated water activities and varying temperatures was studied. The overall results indicated that as the water activity of the liquid decreased from .99 to .85, the heat resistance of the spores increased. The nature of the substance controlling the water activity, and the history of the spores prior to treatment also had an affect on their heat resistance. G.G.

N74-10093# World Meteorological Organization, Geneva (Switzerland).
THE ASSESSMENT OF HUMAN BIOCLIMATE: A LIMITED REVIEW OF PHYSICAL PARAMETERS
H. E Landsberg 1972 48 p refs
(WMO-331; TN-123) Avail: NTIS HC $4.50; WMO, Geneva

Various indices were developed to assess the effects of heat and cold on human beings. They include all elements of the energy balance. These indices require measurements not generally made by meteorological services. But, at the cold end, the factors of wind chill (a combination of temperature of wind speed) or cooling power (including radiative factors) and, at the warm end, effective temperature (a combination of temperature, humidity, and sometimes wind) have proved adequate for biometeorological purposes. The indices can be readily obtained from meteorological measurements or easily available equipment. Bioclimatic classifications to characterize comfort conditions at various localities or for mapping of these conditions for an area were attempted. They are based on atmospheric enthalpy, cooling power, or wind chill. ESRO

N74-10094# Naval Aerospace Medical Research Lab., Pensacola, Fla.
OPERANT BEHAVIOR OF RHESUS MONKEYS IN THE PRESENCE OF EXTREMELY LOW FREQUENCY-LOW INTENSITY MAGNETIC AND ELECTRIC FIELDS (EXPERIMENT 2)
John deLorge 15 Mar. 1973 29 p refs
(MF51524015)

(AD-764532; NAMRL-1179) Avail: NTIS CSCL 06/18

Consonant with the U.S. Navy's exploration of the biological effects of extremely low frequency electromagnetic radiation, the present studies exposed two rhesus monkeys to 10-gauss 45-Hz and 10-Hz fields. Low intensity electric fields occurred simultaneously. No effects of the 45-Hz fields on immediate memory, operant responding, reaction time, or activity were observed. Statistically significant effects were produced by 10-Hz fields, but not in both animals nor in a replication of the experiment. The study failed to provide unequivocal evidence that ELF magnetic and electric fields affect behavior, although weak support for effects of 10-Hz fields on general motor activity was given.
Author (GRA)

N74-10095# Kyushu Univ., Fukuoka (Japan). Dept. of Parasitology.
CHANGES IN ELECTROENCEPHALOGRAM SPECTRA DURING REPEATED EXPOSURE TO +Gz ACCELERATION
Jan Berkhout, Robert D. ODonnell, and Sidney Leverett Wright-Patterson AFB, Ohio AMRL Jun. 1973 37 p refs
(Contract AF 49(638)-1387; AF Proj. 7184)
(AD-764815; AMRL-TR-72-123) Avail: NTIS CSCL 06/19

Eight human subjects experienced a series of +Gz acceleration profiles reaching peak values of +4 1/2 Gz and +6 Gz. Each subject experienced six 45-second +Gz exposures within 15 minutes. Electroencephalograms (EEG) were made throughout this period and subjected to a narrow-band spectral analysis within 10-second epochs. The subjects wore protective G-suits, and did not experience impairment of central vision during the runs analyzed. Small increases in spectral intensity of the EEG were seen during eyes-closed, resting epochs following +Gz exposure. These increases did not change overall shape of spectral profiles and did not exceed normal levels of EEG intensity. During +Gz forces with eyes open, the raw EEG was dominated by electromyographic (EMG) activity, which was typically proportional to instantaneous +Gz force but might also reflect paroxysmal whole-body contractions occurring at scattered points in the +Gz exposure profile. Increased EEG intensities greatly exceeding basal levels for certain narrow frequency bands were observed during actual +Gz exposures. In all subjects, a return to normal EEG spectral intensity profiles took place within 30 seconds of termination of acceleration. (Modified author abstract) GRA

N74-10096# Human Engineering Labs., Aberdeen Proving Ground, Md.
NOISE AND BLAST
David C. Hodge and Georges R. Garinther Jun. 1973 68 p refs
(AD-765419; HEL-TM-10-73) Avail: NTIS CSCL 06/19

The effects of noise and blast upon man are complex and varied. Although this report is directed primarily toward the noise produced during space activities the effects upon man will be similar regardless of the specific noise source. Data are presented dealing with physical acoustics, the characteristics of sound and appropriate noise measurements. Hearing loss resulting from both steady-state and impulse noise is discussed along with the factors influencing its acquisition and recovery and the resultant effects upon performance. Subjective and behavioral response to noise is discussed in terms of masking of auditory signals and speech, annoyance and general observation. Current research in the area of nonauditory effects is reviewed varying from cardiovascular alteraltions to the risk of death. Current design criteria are presented for both steady-state and impulse noise for both workspaces and communities. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems; human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N74-10097 National Lending Library for Science and Technology, Boston Spa (England).
ADYSPAROPSIS AND CONTRAST SENSITIVITY
M. A. Faermark Jul. 1973 10 p refs Transl. into ENGLISH from Svetotekhnika (USSR), no. 11, 1972 p 8-10
(NLL-RTS-8197) Avail: Natl. Lending Library, Boston Spa, Engl., £0.90; 3 NLL photocopy coupons

The effects of dynamic variations in basic contrast sensitivity and of achromatic adysparopsis on the development of ocular fatigue during visual tasks were studied. Comparison of the levels of these two functions as measured before and after proof reading work under different lighting conditions established the optimal illumination in the region of 1200 to 1300 lux. G.G.

N74-10098*# National Aeronautics and Space Administration, Washington, D.C.
SKYLAB EXPERIMENTS. VOLUME 4: LIFE SCIENCES
May 1973 99 p refs
(NASA-EP-113) Avail: NTIS MF $1.45; SOD HC $2.60 Domestic Postpaid or $2.25 GPO Bookstore CSCL 06B

The life sciences experiments conducted during Skylab missions are discussed. The general categories of the experiments are as follows: (1) mineral and hormonal balance, (2) hematology and immunology, (3) cardiovascular status, (4) energy expenditure, (5) neurophysiology, and (7) biology. Each experiment within the general category is further identified with respect to the scientific objectives, equipment used, performance, and data to be obtained. Author

N74-10099*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REMOTE MANIPULATOR SYSTEM Patent Application
D. A. Kugath, Herman T. Blaise, and Dan H. Dane, inventors (to NASA) Filed 11 Oct. 1973 28 p
(NASA-Case-MFS-22022-1; US-Patent-Appl-SN-405341) Avail: NTIS HC $3.50 CSCL 05H

A master-slave manipulator system with two master units is described. The system is controlled by the two arms and hands of an operator and two corresponding slave units. Both the master and the slave units have a first arm rotatably mounted to the floor at 30 deg from the vertical, a second arm pivoted to it and mounted for rotation, and a third arm pivoted to the second arm. The slave has a pivotally and rotatably mounted gripper unit while the master has a pivotally mounted unit with manual switch controls. The servomechanism system includes a solid state control circuit, and flat, helically wound, internal ribbons of wires. NASA

N74-10100*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ORTHOTIC ARM JOINT Patent Application
Dan H. Dane, inventor (to NASA) Filed 4 Oct. 1973 14 p
(NASA-Case-MFS-21611-1; US-Patent-Appl-SN-403694) Avail: NTIS HC $3.00 CSCL 05H

An improved orthopedic (orthotic) arm joint that can be used in various joints of mechanical arms is presented. The arm joint includes a worm, which is coupled to an electric motor for rotating a worm gear carried within a rotatable housing. The worm gear is supported on a thrust bearing and the rotatable housing is supported on a radial thrust bearing. A bolt extends through the housing, bearings, and worm gear for securing the device together. A potentiometer extends through the bolt, and is coupled to the rotatable housing for rotating, so as to produce an electrical signal indicating the angular position of the rotatable housing. NASA

N74-10101*# Life Systems, Inc., Cleveland, Ohio.
ELECTROCHEMICAL CARBON DIOXIDE CONCENTRATOR: MATH MODEL Final Report
R. D. Marshall, F. H. Schubert, and J. N. Carlson Aug. 1973 81 p refs
(Contract NAS2-6478)
(NASA-CR-114639; LSI-ER-134G-6) Avail: NTIS HC $6.25 CSCL 06K

A steady state computer simulation model of an Electrochemical Depolarized Carbon Dioxide Concentrator (EDC) has been developed. The mathematical model combines EDC heat and mass balance equations with empirical correlations derived from experimental data to describe EDC performance as a function of the operating parameters involved. The model is capable of accurately predicting performance over EDC operating ranges.

Model simulation results agree with the experimental data obtained over the prediction range. Author

N74-10102# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
PASSENGER COMFORT LIMITATIONS ON THE DESIGN OF HIGH SPEED TRANSPORTATION SYSTEMS
N. M. Hawkins Jul. 1973 52 p refs
(TT-7309) Avail: NTIS HC $4.75

Problems involved in evaluating a passenger's tolerance of discomfort and defining design criteria for comfort are discussed. Some of the available information on comfort is reviewed for a wide variety of physical parameters of the vehicle environment; noise, vibration and thermal comfort, as well as a more theoretical consideration of the nature of subjective comfort are considered. Author

N74-10103# Southeastern Massachusetts Univ., North Dartmouth. Inst. of Sound and Vibration Research.
SECONDARY TASK PERFORMANCE OF HELICOPTER PILOTS DURING LOW LEVEL FLIGHT
B. K. NagarajaRao and M. J. Griffin Dec. 1971 61 p refs
(ISVR-TR-54) Avail: NTIS HC $5.25 CSCL 05E

Changes in performance at a complex reaction time task during helicopter flight are studied. The two-choice reaction time task employed required responses to a continuous tone and a similar tone pulsed with a 6 Hz repetition frequency. Eight pilots flew two hour flights consisting of 15 minutes at 1000 ft, 90 minutes at 100 ft, and a further 15 minutes at 1000 ft. The mean reaction time data obtained exhibit no significant change between the three flying conditions. Within the low level portions of the flights there was a significant increase in mean reaction time after forty-five minutes of low level flying. With the small pilot sample employed there is evidence of reaction time performance differences between experienced and less experienced pilots. Author

N74-10104# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONCEPT OF FAILURE AS APPLIED TO HUMAN OPERATION
A. I. Gubinskii and G. V. Sukhodolskii 27 Jul. 1973 16 p refs Transl. into ENGLISH from the book " Psikhologiya v Priborostr., S. B. Inzh." USSR, 1967 p 124-131
(AD-764920; FTD-HT-23-694-73) Avail: NTIS CSCL 05/10

The concept of failure is one of the main concepts in the theory of reliability, and deserves special consideration. Technically failure is an event in which the system totally or partially loses its work capacity as a result of which functions assigned by the system, are not fulfilled. GRA

N74-10105# Naval Aerospace Medical Research Lab., Pensacola, Fla.
THE PREDICTION OF PILOT PERFORMANCE IN THE F-4 AIRCRAFT
Richard H. Shannon and Wayne L. Wang 9 Jul. 1973 13 p refs
(MF51524002)
(AD-764866; NAMRL-1186) Avail: NTIS CSCL 05/9

In previous investigations, attempts were made to isolate the most critical skills and procedures within each stage of replacement air group (RAG) training in the F-4 aircraft. For each of the stages analyzed, a small set of items were selected on the basis that they could discriminate among replacement pilots according to their final RAG grade. On the basis of these isolated skills, two fleet evaluation questionnaires were developed to be used by operational F-4 squadron commanders. In addition to ratings on these two rating forms, squadron commanders were asked to report critical incidents. These included such occurrences as accidents, incidents, and wings-pulled. Data obtained from these two forms were used as the criterion measures in the investigation. Selected test scores and flight grades from undergraduate pilot training were used as potential predictors. These were related to the criteria in a series of correlational and regression analyses. A number of significant relationships were obtained among the performance measures. Such results indicated the method used in developing the rating form to be a feasible one. Implications are discussed in terms of potential use for actual assignment of aviators to RAG training in the F-4 aircraft. Author (GRA)

N74-10106# Human Engineering Labs., Aberdeen Proving Ground, Md.
A HUMAN FACTORS ENGINEERING ASSESSMENT OF AN ANATOMICALLY CONFORMING AIRCREW BODY ARMOR SYSTEM
Bernard M. Corona and R. Douglas Jones Jun. 1973 90 p refs
(AD-766296; HEL-TM-9-73) Avail: NTIS CSCL 19/4

An anatomically conforming, four-size, aircrew body armor (ACBA) system, developed by US Army Natick Laboratories, was assessed to determine its compatibility with Army aviator body sizes, flight task requirements and aircrew station geometry. As a base for all comparisons the standard three-size, aircrew body armor (SBA) system was used. Where possible an attempt was made to integrate and utilize elements of the HEL Armor System Development/Evaluation Guideline, TM 18-69. Thirty enlisted men and six officer pilots were used as subjects. As a result of this HFE assessment it has been determined that the ACBA system was not suitable as proposed, the SBA system has serious shortcomings, and the HEL TM 18-69 cannot be utilized for the development or evaluation of body-worn armor systems. Author (GRA)

N74-10107# Air Force Human Resources Lab., Brooks AFB, Tex. Advanced Systems Div.
MODELING OF THE HUMAN FORCE AND MOTION SENSING MECHANISMS Final Report, Nov. 1971 - Jun. 1972
Don R. Gum Jun. 1973 92 p refs
(AF Proj. 6114)
(AD-766444; AFHRL-TR-72-54) Avail: NTIS CSCL 06/19

The purpose of the study was to investigate human force and motion-sensing mechanisms, to develop models for the prominent or potentially artificially stimulatable mechanisms, to implement them on an analog computer, and to investigate their responses to various force and motion-forcing functions. Models were implemented and tested for a semicircular canal, the otolith, head motion muscle spindle sensing, and body seat pressure sensing. Tests of the models have demonstrated the relative time delays between applied force and perceived force for the various mechanisms, showing that both the muscle spindle and pressure-sensing mechanisms perceive an applied force much more rapidly than the vestibular system. Also, the long adaptation phenomenon associated with the semicircular canals which seems to degrade their usefulness in flight and the rapid adaptation phenomenon associated with the pressure sensors which makes them important sensors for consideration in the design of motion systems have been shown through model testing. (Modified author abstract) GRA

N74-10108# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INVESTIGATION OF MANUAL CONTROL IN SECONDARY FLIGHT TRACKING TASKS Annual Technical Report
James G. Curtin, John H. Emery, and Thomas G. Drennen 15 Aug. 1973 59 p refs
(Contract N00014-72-C-0264; NR Proj. 196-120)
(AD-766070; MDC-E0890) Avail: NTIS CSCL 05/5

Four radar control configurations were evaluated for a target acquisition and tracking task as part of a research program directed to control simplification. Control variables included type of control action (displacement or force), location (integrated into throttles or independent), and personal equipment (gloves or no gloves). The four controls were compared for a simulated air-to-ground weapons delivery mission with two navigation segments and a target tracking phase. Sixteen pilots served as subjects in the study. The experimental task was performed in a part-task simulator, employing a PDP-12 general purpose digital computer, a fixed-base crew station configured to resemble an attack aircraft, and the necessary interface software and equipment. Target acquisition and tracking data, time-on-target, and flight command deviations for pitch and roll attitude and airspeed control were recorded. (Modified author abstract) GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N74-10109 National Lending Library for Science and Technology, Boston Spa (England).
PHOSPHORUS AND PHOSPHORUS-CONTAINING INCLUSIONS
V. V. Podgaetskii Jul. 1973 18 p Transl. into ENGLISH of the book "Pori, Vklyuchennya i Trishchini v Zvarnikh Shvakh" Kiev, 1970
(NLL-RTS-7384) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.70: 6 NLL photocopy coupons

Solidification cracking in weld metals is triggered by the formation of low melting integranular films of sulphides or phosphides which are still molten when tensile forces start to develop. Appropriate welding procedures, regulation of the S and P contents in the parent and filler metals, and alloying with chemically active elements are some methods to remove impurities from the molten pool. G.G.

N74-10110 National Lending Library for Science and Technology, Boston Spa (England).
NITROGEN AS AN IMPURITY IN SILICON
V. A. Sinyukov et al Jul. 1973 10 p refs Transl. into ENGLISH of the book "Kristallizatsiya Tonkikh Plenok" Tashkent, 1970
(NLL-RTS-7944) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

Nitrogen introduction during silicon crystal growth by zone melting in a pure hydrogen atmosphere is studied. Absorption spectra and physical measurements show that nitrogen introduced into the silicon lattice without the formation of nitride does not substantially affect the electrical, magnetic, optical, and structural properties up to a concentration of 5 x 10 to the 17th power cu cm. Formation of nitride increased the number of defects considerably in epitaxial layers of silicon. G.G.

N74-10111 Illinois Inst. of Tech., Chicago.
HIGH PRESSURE NON-ISOTHERMAL PROCESSING OF LINEAR POLYETHYLENES Ph.D. Thesis
Kishor Madhusudan Kulkarni 1972 203 p
Avail: Univ. Microfilms Order No. 73-12217

The feasibility of solid phase forming directly from the pellets of linear polyethylenes by using high forming pressure was studied. The high pressure did not facilitate bonding, because it increased the melting point of the material substantially, thus increasing the difference in the melting point and the material temperature. Thereafter, the investigation was directed to study the pressure effect in nonisothermal processing when the material temperature is above its melting point at atmospheric pressure. Mechanical properties and morphology of the material were of primary interest. The tests were conducted in a specially made compression die set with forming pressure of up to 80,000 psi. Four homopolymers and a copolymer, with average molecular weight ranging from 90,000 to nearly 1,000,000, were studied. Dissert. Abstr.

N74-10112*# Dow Chemical Co., Walnut Creek, Calif.
SYNTHESIS OF OPTICALLY CLEAR POLYMERIC MATERIALS FOR HIGH TEMPERATURE WINDOWS Final Report
C. E. Pannell and J. E. Magner 28 Feb. 1973 98 p refs
(Contract NAS2-6338)
(NASA-CR-114681) Avail: NTIS HC $7.00 CSCL 07D

A polymer has been developed that has excellent potential for use as windows in spacecraft as well as conventional aircraft. This polymer, phenolphthalein polycarbonate, has outstanding thermal properties, e.g., in place of melting or burning, it produces an insulating charred foam that closes off transmission of radiant heat through the window. This fact, coupled with an oxygen index of 0.43 and a 177 C tensile strength of 58 mega Newtons/sq m, makes this polymer a prime candidate for further development. Pilot plant preparation in a 20 gallon Pfaudler kettle was accomplished and large test specimens were prepared for evaluations. Author

N74-10113# Bureau of Mines, Pittsburgh, Pa. Energy Research Center.
AN ALGORITHM FOR CALCULATING MULTIPHASE CHEMICAL EQUILIBRIUM
F. E. Spencer, Jr. and A. A. Orning 1973 45 p refs
(BM-RI-7786) Avail: NTIS HC $4.25

A complete mathematical description is provided of the algorithm employed by a general multiphase chemical equilibrium program developed particularly for the purpose of studying problems in coal combustions, although the generality of the program will allow its application to any equilibrium system in which an appreciable gas phase is present. When applied to coal combustion problems, the program predicts composition and quantity of slag and unconsumed carbon phases as well as calculates accurately the composition of the gas phase including trace species such as free electrons and ions which are important for predicting electrical properties. Author

N74-10114# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
SMOG CHAMBER REACTIVITIES OF EMISSIONS FROM LEADED AND LEAD-FREE FUELS
G. P. Sturm, Jr. and Basil Dimitriades 1973 17 p refs
(BM-RI-7803) Avail: NTIS HC $3.00

Photochemical specific reactivities were determined in emissions from automobiles using leaded-premium- and regular-grade fuels and prototype lead-free fuels of comparable octane quality. Emissions were photoirradiated in a 100 cu ft environmental (smog) chamber at three sets of initial hydrocarbon and oxides of nitrogen concentrations. Reactivity was measured and expressed in terms of rate-of-NO2 formation and dosages of oxidant, peroxyacetyi nitrate (PAN), peroxypropionyl nitrate (PPN), and formaldehyde (HCHO). The results indicate that the evaporative emission samples and the evaporative plus exhaust emissions samples from the lead-free fuels have higher reactivities per gram than those from the leaded fuels. For the samples containing only exhaust emissions, the only trend observed was the lower specific reactivity exhibited by the leaded premium fuel exhaust. These differences in specific reactivity are taken to reflect the differences in hydrocarbon composition of the fuels and their evaporative and exhaust emissions rather than any difference in lead content per se. Author

N74-10115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOIONIZATION FROM EXCITED STATES OF HELIUM
Verne L. Jacobs (NAS-NRC) Nov. 1973 36 p refs Submitted for publication
(NASA-TM-X-70496; X-641-73-317) Avail: NTIS HC $4.00 CSCL 07D

The cross sections for photoionization from the 2 1S, 2 3S, 2 1P and 2 3P excited states of helium are calculated for photoelectron energies below the n = 2 threshold of He(+) using Hylleraas bound state wave functions and 1s-2s-2p close coupling final state wave functions. The resonant structures associated with the lowest-lying 1S, 1P, 3P, and 1D autoionizing states of helium are found to be characterized by large values of the line profile parameter q. The cross sections and the photoelectron angular distribution asymmetry parameters for the P-states are calculated for various polarization states of the target atom and the incident photon. Experiments which would lead to the separate determinations of the S- and D- wave partial photoionization cross sections are discussed. Author

N74-10116# National Physical Lab., Teddington (England). Div. of Chemical Standards.
SUMMARY OF THE DIVISION'S CAPABILITIES IN MEASUREMENT STANDARDS, DATA ASSESSMENT AND MATERIALS CHARACTERIZATION
A. J. Head, ed. May 1973 24 p
(NPL-Chem-22) Avail: NTIS HC $3.25

Capabilities of the division on chemical standards, NPL (Great Britain), for work on measurement, standards, data assessments, and materials characterization are summarized. The range of applicability of available apparatus and techniques is given together with the amount of sample required for a measurement and the accuracy to be expected from it. ESRO

N74-10117# Quality Assurance Directorate (Materials), London (England).
THE DETERMINATION OF CHLORIDE, BROMIDE AND IODIDE BY COOL FLAME EMISSION SPECTROSCOPY
C. Heathcote, R. Dunk, and R. A. Mostyn Jun. 1972 27 p refs
(QAD-MATS-196; BR33373) Avail: NTIS HC $3.50

An analytical technique for the determination of the halides was studied, based on measurement of the indium halide molecular emissions produced during nebulization of indium nitrate doped aqueous halide solution into a cool hydrogen-nitrogen diffusion flame. For the emission In Cl 3599A, InBr 3758A, InI 4099A the limits of detection are Cl3, Br5, and I 0.2 mu g/ml respectively. Results are given for the determination of chloride in papers. It was concluded that the cool flame emission spectrum of an unknown solution, treated only by the addition of indium, is the most rapid and sure test yet produced for the qualitative identification of chlorine, bromine, and iodine. ESRO

N74-10118# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Science Div.
IDENTIFICATION OF HYDROGEN IN MATERIALS BY RESONANCE DETECTION OF NEUTRONS
Robert L. Becker and John J. Antal Jun. 1973 19 p refs
(AD-765451; AMMRC-PTR-73-8) Avail: NTIS CSCL 07/4

As a first step in the development of techniques for detection of the presence or absence of a hydrogen-containing component in a larger mechanical assembly, resonance detection of elastically-scattered neutrons in hydrogenous materials was explored. A phosphor-photographic film technique was found to be much less satisfactory than a direct counting technique for the scattered neutrons which identified the presence of milligram quantities of hydrogen. Large improvements in sensitivity, compactness, and operator safety can be provided by implementation of further developments detailed in the report. Author (GRA)

N74-10119# Pennsylvania Univ., Philadelphia. Dept. of Chemistry.
COMMENT ON THE BENDING MODE OF Al2O
Charles P. Marino and David White 15 Aug. 1973 11 p
(Contract N00014-67-A-0216-0001)
(AD-765733; TR-7) Avail: NTIS CSCL 07/4

Infrared Spectra were recorded at 4K of samples resulting from the co-deposition of atomic aluminum emanating from an Al2O3 Knudsen cell and 5% O2 in argon mixtures. The spectra exhibited two prominent features, one at 992/cm and one at 496/cm. The 992/cm feature has previously been assigned to Al2O. The 496/cm absorption was shown by means of isotopic labelling studies to arise from a species containing two symmetrically positioned oxygen atoms. This species is tentatively thought to be Al2O2. Author (GRA)

N74-10120# Ballistic Research Labs., Aberdeen Proving Ground, Md.
FORMATION OF PYROPHORIC FRAGMENTS Memorandum Report, Jun. 1971 - Dec. 1972
Warren W. Hillstrom Jun. 1973 34 p refs Supersedes BRL-IMR-46
(DA Proj. 1T0-61102-A-33E)
(AD-765447; BRL-MR-2306; BRL-IMR-46) Avail: NTIS CSCL 07/4

An empirical correlation was developed to predict pyrophoric sparking from two properties: (1) the standard free energy of formation per oxygen atom in the metal oxide and (2) the metal oxide volume compared with metal volume. A simple impact test was developed to study large pyrophoric pellets and the formation of free flying fragments in the laboratory. The paper describes the test and reports test results for cerium, misch metal, zirconium, and titanium. Each of the metals exhibited different threshold conditions for initiation of pyrophoric sparking. An experimental criterion was defined as the lower glow temperature. (Modified author abstract) GRA

N74-10121# Naval Postgraduate School, Monterey, Calif.
THE MECHANISM OF HIGH PRESSURE OXIDATIONS OF ALIPHATIC ACIDS M.S. Thesis
Yakup Oner Jun. 1973 65 p refs
(AD 765737) Avail: NTIS CSCL 07/3

As a part of the study of the mechanism of high pressure oxidation of aliphatic acids,acetic acid solutions were oxidized. No oxidation was observed at the end of several reactions without a catalyst. Increasing temperature showed an increasing reaction rate, while increases in pressure and decreases in concentration showed a decreasing effect on the reaction rate. (Modified author abstract) GRA

N74-10122# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CHARGED PARTICLE REACTIONS INVOLVING OXYGEN AND NITROGEN IN THE E- AND F-REGIONS Environmental Research Papers
William Swider 13 Jun. 1973 27 p refs
(AF Proj. 8605)
(AD-766243; AFCRL-TR-73-0361; AFCRL-ERP-448) Avail: NTIS CSCL 07/4

Two-body ionospheric reactions involving oxygen and/or nitrogen are briefly reviewed with special emphasis on the temperature dependencies of these reactions and reactions involving excited ions. The temperature dependence of most reactions are fairly well known except for processes which can occur over a wide range of thermospheric temperatures, particularly O and/or O(-) reactions and dissociative recombination processes. Disagreements between laboratory and aeronomically deduced loss processes for O(-) ions are discussed. The absence of laboratory measurements of excited ion reactions at typical E- and F-region temperatures hinders twilight and auroral studies. The lack of knowledge concerning the state of excitation of reaction products impairs airglow and chemical aeronomy studies. The reaction between O(2(-) and NO may be an important source of electronically excited O2 molecules in auroras. GRA

N74-10123# Naval Ordnance Lab., White Oak, Md.
SYNTHESIS OF EPOXY RESINS FOR PROPERTY-STRUCTURE STUDIES
Hubert J. Booth 26 Jul. 1973 26 p refs
(RR0130201)
(AD-765694; NOLTR-73-112) Avail: NTIS CSCL 07/3

The preparation and thermal characteristics of twelve epoxy resins designed to a wide spread of properties are described. The epoxy monomers include diglycidyl ether of bisphenol A (DGEBA), resorcinol diglycidyl ether (RDGE), and butanediol diglycidyl ether (BDGE). Curing agents include 1,3-Propanediamine ,PDA), 1,6-Hexanediamine (HDA), 1,12-Dodecanediamine (DDA), and m-phenylenediamine (MPDA). GRA

N74-10124# Union Carbide Research Inst., Tarrytown, N.Y.
THE PREPARATION AND PROPERTIES OF D2-CARBORANE-SILOXANES
G. B. Dunks, E. Hedaya, J. H. Kawakami, P. W. Kopf, G. T. Kwiatkowski, D. W. McNeil, and R. W. Tulis 30 Jul. 1973 57 p refs
(Contract N00014-72-C-0277; NR Proj. 356-525)
(AD-766147; UCRI-735; TR-1) Avail: NTIS CSCL 07/3

A flexible chemical synthesis of linear D2-carborane-siloxanes has been achieved which permits wide structural variations and high molecular weights (< or + or - 130,000). These materials have excellent mechanical and thermal-oxidative properties. Prepolymers with well-defined reactive end groups have been prepared. The feasibility of curing these materials through vinyl functionalities using conventional silicone rubber technology has been demonstrated. The use of proton nmr to monitor and help control the polymerization has been demonstrated and may have more general utility. (Modified author abstract) GRA

N74-10125# North Carolina Univ., Chapel Hill. Dept. of Chemistry.
FUNDAMENTAL STUDIES OF ELECTROCHEMICAL PROCESSES Final Scientific Report
Royce W. Murray and Charles N. Reilley Aug. 1973 30 p refs
(Grant AF-AFOSR-1625-69; AF Proj. 9536)
(AD-765643; AFOSR-73-1407TR) Avail: NTIS CSCL 07/4

This project has had as its main theme study, on a broad front of research, the modes of energy transfer which can

accompany an electrochemically induced charge transfer process. A variety of high energy, reactive radicals have been studied and a framework of decay pathways and strategy for experimental investigations has been proposed. Significant aspects of electrochemical techniques, theory, and instrumentation developed during our studies of energy transfer modes have been (1) development of cryoelectrochemistry, (2) continued improvement of spectroelectrochemical methods, (3) introduction of stopped-flow kinetic methods as applied to electrochemically important chemical reactions, and (4) treatment of the cases of reactant and product adsorption in studies of electrochemically induced decay reactions. This project has also discovered an instance of surface solubility-controlled two-dimensional crystal formation in adsorption of a metal complex on a mercury electrode from aqueous solution. Author (GRA)

N74-10126# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REFINEMENT OF THE WILLIAMS-LANDEL-FERRY EQUATION
D. S. Sanditov and G. M. Bartenev 6 Aug. 1973 13 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), v. 14, no. 12, 1972 p 882-885
(AD-766000; FTD-HT-23-831-73) Avail: NTIS CSCL 07/4

The authors propose in this Russian translation a refinement of the Williams-Landel-Ferry equation for the temperature dependence of the relaxation time during the rapid stage of physical relaxation of polymers above the glass-transition temperature T(c). In this equation they have considered the dependence of T(c) on the cooling rate; in place of coefficient a2, having the dimension of temperature and a function of the type of polymer, they have introduced a dimensionless, practically universal constant a(0) + or - (1 - a2/T(c)) about 0.68. GRA

N74-10127# Ohio State Univ., Columbus. ElectroScience Lab.
EXPERIMENTAL STUDIES OF THE PARTIAL AND TOTAL PRESSURE DEPENDENCE OF WATER VAPOR ABSORPTION COEFFICIENTS FOR HIGHLY TRANSMITTING CO LASER LINES Quarterly Report, 23 Mar. - 23 Jun. 1972
R. K. Long, F. S. Mills, and G. L. Trusty Feb. 1973 44 p refs
(Contract F30602-72-C-0016; ARPA Order 1279)
(AD-760139; ESL-3271-4; RADC-TR-73-125; QR-4) Avail: NTIS CSCL 07/4

Laboratory water vapor absorption measurements at CO laser frequencies are described. A companion report which is being issued at the same time includes a more extensive discussion of the experimental methods which are common to the measurements in this report. Author (GRA)

N74-10128# Army Foreign Science and Technology Center, Charlottesville, Va.
COMMERICAL PETROLEUM PRODUCTS, PROPERTIES AND APPLICATIONS
N. G. Puchkov 21 Dec. 1972 685 p Transl. into ENGLISH of the publ. "Tovarnye Nefteprodukty, Ih Sovistva i Primenenie" Moscow, Khim., 1971
(AD-754703; FSTC-HT-23-1838-72) Avail: NTIS CSCL 07/1

Replacing an earlier reference work, Tekhnicheskiye Normy na Nefteprodukty (Technical Standards for Petroleum Products), the handbook updates this field by inclusion of additional products and discussion of properties and applications. Covered are fuels, oils, lubricants, and other commercial petroleum products produced by Soviet oil refining enterprises. Standards, technical conditions, component composition, main operating qualities, and uses of these products are discussed. Author (GRA)

N74-10129# Bureau of Mines, Washington, D.C.
THE ASSOCIATION OF AUTOMOTIVE FUEL COMPOSITION WITH EXHAUST REACTIVITY
Basil Dimitriades, B. H. Eccleston, G. P. Sturm, Jr., and C. J. Raible Jul. 1973 57 p refs Prepared for Environ. Protection Agency Research Triangle Park, N. C.
(PB-222609/0; BM-RI-7756) Avail: NTIS HC $3.50 CSCL 07E

The association of automotive fuel composition with exhaust reactivity was studied in an experimental program that involved testing with different automotive engines and with gasolines of varied composition. Results showed clearly the exhaust reactivity to increase with increasing levels of polyalkylbenzenes in the fuel. For the purposes of the study, had it been possible, fuel composition should have been defined and expressed in terms of component groups such that the potential for exhaust reactivity would be the same within each group and different from group to group. Statistical analysis of the mass emissions data showed significant car and fuel effects on hydrocarbon, carbon monoxide, nitric oxide, total aldehydes, and formaldehyde emission levels and on total photochemical reactivity. Correlations were found between mass emission parameters and fuel composition. (Modified author abstract) GRA

N74-10130# Pittsburgh Univ., Pa.
ABSOLUTE RATE CONSTANT FOR THE O PLUS NO CHEMILUMINESCENCE IN THE NEAR INFRARED
Michael F. Golde, Aidan E. Roche, and Frederick Kaufman Apr. 1973 29 p refs
(Contracts DA-31-124-ARO(D)-440; F19628-70-C-0255; ARPA Order 826)
(AD-762196; SRCC-187) Avail: NTIS CSCL 07/4

Infrared chemiluminescence from the process O NO (-M) to NO2 - hv (-M) has been studied between 1.3 and 4.1 micrometers. The wavelength dependence of the continuum between 1.3 and 3.3 micrometers is in fair agreement with previous studies and the measured radiative rate constant at 1.51 micrometers establishes the NO-O glow in this spectral range as a secondary emission standard. In the region 3.3 to 4.1 micrometers, the previously-observed broad band, peaking at 3.7 micrometers, shows a complex kinetic dependence on (O) and (M). (Modified author abstract) GRA

N74-10131# Aerospace Corp., El Segundo, Calif. Astrophysics Lab.
VIBRATIONAL RELAXATION MEASUREMENTS BY A COMBINED SHOCK TUBE-LASER INDUCED FLUORESCENCE TECHNIQUE Report for Apr. - Dec. 1972
Jerry F. Bott and Norman Cohen 25 Aug. 1973 24 p refs (Contract F04701-73-C-0074)
(AD-766257; TR-0074(4530)-6) Avail: NTIS CSCL 07/4

Vibrational relaxation measurements in HF and DF have been obtained at intermediate temperatures by combining the laser-induced fluorescence technique with shock compression heating in a shock tube. The combination of the two techniques has several advantages: it permits measurements over a wide range of temperatures, and eliminates problems of wall reactions and leaky cells at high temperatures. This method was used to obtain HF and DF vibrational relaxation data in the presence of various chaperon molecules at temperatures from 460 to above 1000K and at room temperature. Data for the V-V energy transfer from DF to various diatomics were obtained from 295 to 700K and above. (Modified author abstract) GRA

N74-10274* Aerospace Corp., El Segundo, Calif.
THE FAR ULTRAVIOLET PHOTOLYSIS OF POLYMETHYLPHENYLSILOXANE FILMS ON QUARTZ SUBSTRATES
P. D. Fleischauer and L. Tolentino *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 645-650 refs (For availability see N74-10232 01-11)
CSCL 07D

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N74-10132* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD AND APPARATUS FOR A SINGLE CHANNEL DIGITAL COMMUNICATIONS SYSTEM Patent
Lucien A. Couvillon, Jr., Christopher Carl, Richard M. Goldstein, Edward C. Posener, and Richard R. Green, inventors (to NASA)

Issued 16 Oct. 1973 25 p Filed 27 Jun. 1972 Supersedes N72-28164 (10 - 19, p 2526) Continuation-in-part of US Patent Appl. SN-70967, filed 11 Sep. 1970 Sponsored by NASA
(NASA-Case-NPO-11302-2; US-Patent-3,766,315; US-Patent-Appl-SN-266822; US-Patent-Class-178-69.4R; US-Patent-Appl-SN-70967) Avail: US Patent Office CSCL 17B

A method and apparatus are described for synchronizing a received PCM communications signal without requiring a separate synchronizing channel. The technique provides digital correlation of the received signal with a reference signal, first with its unmodulated subcarrier and then with a bit sync code modulated subcarrier, where the code sequence length is equal in duration to each data bit. Official Gazette of the U.S. Patent Office

N74-10133 Ohio State Univ., Columbus.
A LOOK AT THE ANTENNA RADIATION PROBLEM IN THE TIME DOMAIN Ph.D. Thesis
Pearson Dudley McWane 1972 230 p
Avail: Univ. Microfilms Order No. 73-11536

The radiating properties of three arbitrarily excited antenna structures, the rectangular aperture, the one dimensional element array and the end- and center-fed dipoles, are analyzed using time domain techniques. Relationships are presented which express the radiated electric field in the far field region in terms of an arbitrarily time varying excitation current on the radiating structure. The radiation field is presented graphically in the form of a pictorial space time plot, showing its variation with time throughout 180 deg of look angle. In particular the delta function response of the three structures is presented. Dissert. Abstr.

N74-10134 Montana State Univ., Missoula.
SYNTHESIS TECHNIQUES USEFUL IN THE GENERATION OF PRECISE MICROWAVE FREQUENCIES Ph.D. Thesis
Kenneth Eugene Marcotte 1972 213 p
Avail: Univ. Microfilms Order No. 73-10952

The general principles of direct and indirect methods of frequency synthesis are described. Signal operations of frequency translation, multiplication and division are analyzed and degradation of the input signal stability is discussed. Synthesis techniques which have application in the VHF and UHF frequency ranges under investigation are presented. Dissert. Abstr.

N74-10135 Maryland Univ., College Park.
OPTIMUM FILTERING AND DETECTION FOR DOUBLY STOCHASTIC SHOT NOISE PROCESSES IN WHITE GAUSSIAN NOISE Ph.D. Thesis
Koji Kurimoto 1972 145 p
Avail: Univ. Microfilms Order No. 73-11399

For the problem of the optimum filtering and binary detection of signals at optical frequencies, two classes of problems involving Poisson processes are considered. First, the theory of point processes is applied to conditional Poisson processes to find the statistics of the photoelectron counting processes for the detection of a Gaussian field. Second, the method of the time evolution of the conditional characteristic function for doubly stochastic Poisson processes in white Gaussian noise is applied to the problem of filtering and detecting a coherent field through a turbulent channel including the effects of the detector's response, shot noise and thermal noise. Dissert. Abstr.

N74-10136 Kansas Univ., Lawrence.
THE RELATIVE EFFECTS OF SYSTEM AND SURFACE PARAMETERS ON RETURN SIGNAL FADING Ph.D. Thesis
Arye Zachs 1972 141 p
Avail: Univ. Microfilms Order No. 73-11971

The analogy between fading and narrow band noise signals is utilized for a proposed analysis of the incoherently detected fading signal. The experimental part of this study consisted of an acoustic simulation of fading radar returns from irregular man made targets. The scattering surfaces were moved in both continuous and incremental modes. It was shown that only when the surface was relatively smooth did the statistical analysis of the fading exhibit a deviation from the conventional fading (Doppler) theory. However, when the rms slope of the surface was larger than a few degrees and the size of the illuminated area longer than a few correlation distances, the measurements were very close to those from an actual collection of random independent scatters and to the common fading theory. Dissert. Abstr.

N74-10137*# Stanford Univ., Calif.
TELECONFERENCING, AN ANNOTATED BIBLIOGRAPHY, VOLUME 3 Final Report
Katherine Shervis Oct. 1971 297 p refs
(Grant NGR-05-020-517)
(NASA-CR-133590) Avail: NTIS HC $17.00 CSCL 17B

In this annotated and indexed listing of works on teleconferencing, emphasis has been placed upon teleconferencing as real-time, two way audio communication with or without visual aids. However, works on the use of television in two-way or multiway nets, data transmission, regional communications networks and on telecommunications in general are also included. Author

N74-10138*# Ohio State Univ., Columbus. ElectroScience Lab.
LOW RESOLUTION RADAR DIGITAL INTERFACE
May 1973 66 p
(Grant NGR-36-008-080)
(NASA-CR-132829; TR-2374-14) Avail: NTIS HC $5.50 CSCL 17I

This document describes the design and operation of a low resolution radar data recording system for precipitation measurements. This system records a full azimuth scan on seven track magnetic tapes every five minutes. It is designed to operate on a continuous basis with operator intervention required only for changing tape reels and calibration. Author

N74-10139*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON-BOARD PROCESSING FOR DATA COLLECTION SATELLITE SYSTEMS Final Report
Frank Fellinger, G. R. Cooper, and P. A. Wintz Apr. 1973 231 p refs
(Grant NGR-15-005-143)
(NASA-CR-132832; TR-EE-73-19) Avail: NTIS HC $13.75 CSCL 20N

Transform methods for estimating a set of signal frequencies are considered. The discrete Fourier transform, the discrete Signum transform and the Walsh-Hadamard transform are applied to the measurement of frequency of sinusoidal signals having unknown parameters, contaminated by white Gaussian noise, and the performance of each transform method is analyzed. The measurement of frequency of unknown signals is a noncoherent maximum likelihood measurement and is optimally performed in the frequency domain. Author

N74-10140*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
THE INFLUENCE OF POLARIZATION ON MILLIMETER WAVE PROPAGATION THROUGH RAIN Ph.D Thesis. Interim Report
Paris H. Wiley, Charles W. Bostian, and Warren L. Stutzman 15 Jun. 1973 89 p refs
(Grant NGR-47-004-091)
(NASA-CR-132815) Avail: NTIS HC $6.50 CSCL 20N

The influence of polarization on millimeter wave propagation is investigated from both an experimental and a theoretical viewpoint. First, previous theoretical and experimental work relating to the attenuation and depolarization of millimeter waves by rainfall is discussed. Considerable detail is included in the literature review. Next, a theoretical model is developed to predict the cross polarization level during rainfall from the path average rain rate and the scattered field from a single raindrop. Finally, data from the VPI and SU depolarization experiment are presented as verification of the new model, and a comparison is made with other theories and experiments. Aspects of the new model are: (1) spherical rather than plane waves are assumed, (2) the average drop diameter is used rather than a drop size distribution, and (3) it is simple enough so that the effect which changing one or more parameters has on the crosspolarization level is easily seen. Author

N74-10141*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Electrical Engineering.
THE INFLUENCE OF POLARIZATION ON MILLIMETER WAVE PROPAGATION THROUGH RAIN Semiannual Status Report, 1 Jan. - 30 Jun. 1973
Charles W. Bostian, Warren L. Stutzman, Paris H. Wiley, and Robert E. Marshall 1 Jul. 1973 123 p refs
(Grant NGR-47-004-091)
(NASA-CR-132819; SASR-3) Avail: NTIS HC $8.25 CSCL 20N

The measurement and analysis of the depolarization and attenuation that occur when millimeter wave radio signals propagate through rain are described. Progress was made in three major areas: the processing of recorded 1972 data, acquisition and processing of a large amount of 1973 data, and the development of a new theoretical model to predict rain cross polarization and attenuation. Each of these topics is described in detail along with radio frequency system design for cross polarization measurements. Author

N74-10142*# Maryland Univ., College Park. Dept. of Electrical Engineering.
USER MICROPROGRAMMABLE PROCESSORS FOR HIGH DATA RATE TELEMETRY PREPROCESSING
James H. Pugsley and E. P. OGrady Jul. 1973 29 p refs
(Grant NGR-21-002-355)
(NASA-CR-132830) Avail: NTIS HC $3.50 CSCL 09F

The use of microprogrammable processors for the preprocessing of high data rate satellite telemetry is investigated. The following topics are discussed along with supporting studies: (1) evaluation of commercial microprogrammable minicomputers for telemetry preprocessing tasks; (2) microinstruction sets for telemetry preprocessing; and (3) the use of multiple minicomputers to achieve high data processing. The simulation of small microprogrammed processors is discussed along with examples of microprogrammed processors. K.M.M.

N74-10143*# Magnavox Co., Silver Spring, Md. Advanced Systems Analysis Office.
TELEMETRY CODING STUDY FOR THE INTERNATIONAL MAGNETOSPHERE EXPLORERS, MOTHER/DAUGHTER AND HELIOCENTRIC MISSIONS. VOLUME 2: FINAL REPORT
David E. Cartier Aug. 1973 242 p refs This volume contains Vol. 1 (the only other volume) and as such is complete in itself
(Contract NAS5-20386)
(NASA-CR-132834; ASAO-PR20046-4-Vol-2) Avail: NTIS HC $14.25 CSCL 09F

A convolutional coding theory is given for the IME and the Heliocentric spacecraft. The amount of coding gain needed by the mission is determined. Recommendations are given for an encoder/decoder system to provide the gain along with an evaluation of the impact of the system on the space network in terms of costs and complexity. Author

N74-10144*# Atlantic Science Corp., Indialantic, Fla.
TRACKING DATA RELAY SATELLITE SYSTEM (TDRSS) VHF PROPAGATION STUDY
Lee Ann H. Schleicher, Sigrid K. Llewellyn, and Rodney B. Bent 15 Jun. 1973 53 p Prepared for DBA Systems, Inc., Melbourne, Fla.
(Contract NAS5-21725)
(NASA-CR-132823) Avail: NTIS HC $4.75 CSCL 20N

A study performed to investigate the use of the Bent Ionospheric Model in computing corrections to the range and range rate measurements of the TDRSS satellites is documented. Several orbital configurations between the two satellites are discussed as to their effects on total electron content along the radio path between the satellites. Problem areas in the accurate computation of total electron content and range rate corrections are also discussed. The Bent Ionospheric Model gives the electron density versus height profile as a function of latitude, longitude, height, time, season, and solar flux. Author

N74-10145*# Airborne Instruments Lab., Deer Park, N.Y.
ADAPTIVE GROUND IMPLEMENTED PHASED ARRAY Final Report, Aug. 1971 - Feb. 1973
James M. Smith Feb. 1973 101 p refs
(Contract NAS5-21653)
(NASA-CR-132827) Avail: NTIS HC $7.25 CSCL 17B

Tests were conducted to determine the feasibility of using an adaptive ground implemented phased array (AGIPA) to overcome the limitations of the radio frequency interference limited low data Tracking and Data Relay Satellite VHF return link. A feasibility demonstration model of a single user channel AFIPA system was designed, developed, fabricated, and evaluated. By scaling the frequency and aperture geometry from VHF to S-band, the system performance was more easily demonstrated in the controlled environment of an anechoic chamber. The testing procedure employs an AGIPA in which received signals from each element of the array are processed on the ground to form an adaptive, independent, computer controlled beam for each user. Author

N74-10146# RAND Corp., Santa Monica, Calif.
INTERCONNECTING CABLE TELEVISION SYSTEMS BY SATELLITE: AN INTRODUCTION TO THE ISSUES
Nathaniel E. Feldman Jun. 1973 30 p refs Presented at 112th Tech. Conf. of the Soc. of Motion Picture and Television Eng., Los Angeles, 26 Oct. 1972
(P-5035) Avail: NTIS HC $3.50 CSCL 09F

Hard facts and questions about cable TV, especially the prospects for utilization of interconnection satellites are considered. Author

N74-10147*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ERRONEOUS MEASUREMENTS TRANSMITTED BY TELEMETRY. APOLLO 17 MISSION
May 1973 14 p
(NASA-TM-X-69403; Anomaly-1; JSC-07985) Avail: NTIS HC $3.00 CSCL 09F

The factors are analyzed which caused erroneous data to be transmitted by 60 of the 1 sample-per-second telemetry channels for a 2-minute period beginning at about 191 hours 40 minutes. It is concluded that a failure occurred somewhere in the last four stages of a programmer counter. Corrective action to be taken in the Skylab and Apollo Soyuz Test Program spacecraft is specified. D.L.G.

N74-10148# Australian Post Office Research Labs., Melbourne.
DIGITAL CAPACITY OF STANDARD COAXIAL PAIR
A. J. Gibbs Mar. 1973 20 p refs
(Rept-6647) Avail: NTIS HC $3.00

The feasibility of using standard coaxial pair as a bearer for multilevel digital transmission systems is considered. The digital capacity of such systems is estimated and suggestions for further work in this area are advanced. Author

N74-10149# Japan Broadcasting Corp., Tokyo. Image Devices Research Group.
AN EXPERIMENTAL TV DISPLAY USING A GAS DISCHARGE FLAT PANEL
Hiroaki Ikeda, Tetsuo Sakai, Iwao Ohishi, and Teruo Hirashima Aug. 1973 8 p refs
(NHK-LABS-NOTE-167) Avail: NTIS HC $3.00

An experimental set-up was constructed to display a portion of a monochrome picture, reproduced from NTSC TV signals, on a flat panel display panel device. The set-up uses a combination of a 77 by 222 dot gas-discharge display panel developed for graphic displays, and a set of analog memories and associated circuitries utilizing MOS-LSIs. The experimental set-up covers TV pictures occupying a range of about 24 percent of the horizontal and about 90 percent of the vertical deflections. A luminance of up to 15 ft-L, a contrast ratio of up to 1:, and a-variation in luminance of 2 percent were obtained in the experimental set-up. Author

N74-10150# Japan Broadcasting Corp., Tokyo.
EXPERIMENTS ON TELEVISION PICTURE SHARPNESS IN RELATION TO MODULATION-TRANSFER FUNCTION OF THE VISUAL SYSTEM
Haruo Sakata and Hideo Kusaka Jun. 1973 15 p refs
(NHK-LABS-NOTE-165) Avail: NTIS HC $3.00

The spatial frequency response equalization in relation to

low pass filtering and the result of an assessment experiment are reported. The optimal degree of equalization, when it is applied to the signal source using vidicon pickup tubes, lies around-12db for the luminance signal and around -7db for the chrominance signal, and this represents an improvement of 1 to about 1.5 grades over the case with no equalization. Unlike the picture equalized by an image enhancer or horizontal aperture equalizer, one equalized under this system has a natural contour emphasis effect. Author

N74-10151# Institute for Telecommunication Sciences, Boulder, Colo.
MODELING THE EFFECTS OF CLOUDS AND RAIN UPON SATELLITE-TO-GROUND SYSTEM PERFORMANCE
E. J. Dutton and H. T. Dougherty Mar. 1973 54 p refs
(OT-73-5) Avail: NTIS HC $4.75

A state-of-the-art engineering model is described for estimating the expected performance degradation of satellite-to-ground microwave systems because of atmospheric gases, clouds, and rain. The model incorporates an allowance for a vertical structure of atmospheric gases, clouds, and rain as well as local and regional rainfall statistics. The estimates are in terms of attenuation and scintillation, as well as the volume reflectivity which contributes to cochannel interference. A composite prediction is given for 15 GHz, as representative of microwave signals, for 1.0, 0.1, and 0.01 percent of an average year. This prediction is a function of location and the angle of arrival at ground stations on the central east coast of the U. S. Author

N74-10152# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
MEASUREMENT OF RF POWER AND ATTENUATION USING SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES
R. A. Kamper, M. B. Simmonds, C. A. Hoer, and R. T. Adair Aug. 1973 94 p refs Sponsored in part by Army Metrology Center, Huntsville, Ala., Navy Metrology Center, Pomona, Calif., and AF Metrology, Newark, Ohio
(NBS-TN-643) Avail: SOD HC $1.00 as C13.46:643

Superconducting quantum interference devices are comprised of a simple circuit of superconducting metal that operates at a very low temperature in a liquid helium bath. The device functions as a sensor of magnetic flux with an almost perfectly periodic response over a wide dynamic range; therefore, it can be used to measure dc or RF electrical qualities such as current, power, and attenuation in circuits inductively coupled to it. Measurements of these quantities can be made by counting off periods in the response of the SQUID (flux quanta). After an elementary exposition of the basic principles of the technique, a description is given of: (1) the SQUIDS themselves, (2) prototype systems developed to measure RF power and attenuation, (3) systematic errors and fundamental limitations of the measurements that can be performed, and (4) obvious and immediate improvements that can be applied to SQUIDS. An appendix covers drawings and instructions for the fabrication of device components. Author

N74-10153# Joint Publications Research Service, Arlington, Va.
SATELLITE COMMUNICATIONS SYSTEMS
Nikolay Ivanovich Kalashnikov 17 Nov. 1971 68 p refs Transl. into ENGLISH of the book "Sistemy Svyazi Cherez Iskusstvennyye Sputniki Zemli " Moscow, Communications Publishing House, 1969
(JPRS-54505) Avail: NTIS HC $5.50

Multiplexing principles for communications lines are discussed in terms of a channeling device for transmitting a television signal and a sound signal. The transmitting and receiving devices used in ground stations are described, and the required secondary equipment systems are listed. Particular reference is made to the ground stations of the Molniya I and Orbita satellites. The design principles of onboard receiving and transmitting equipment and antennas are also examined. T.M.R.

N74-10154*# Magnavox Research Labs., Torrance, Calif.
ADVANCED TRACKING AND DATA RELAY EXPERIMENT STUDY: MULTIMODE TRANSPONDER EXPERIMENT Final Report, Sep. 1972 - Sep. 1973
R. S. Cnossen 15 Sep. 1973 49 p
(Contract NAS5-21824)
(NASA-CR-132844) Avail: NTIS HC $4.50 CSCL 17B

A series of experiments utilizing a multimode transponder mounted in an aircraft working either through a spacecraft or directly with a ground station is studied. The purpose of the experiments is to determine the best modulation and encoding techniques for combating RFI and multipath propagation and to determine the characteristics of VHF and UHF RFI in discreet bands. The experiments would also determine the feasibility and accuracy of range and range rate measurements with the various modulation and encoding techniques. Author

N74-10155# Chicago Univ., Ill. Dept. of Geophysical Sciences.
OBJECTIVE DETERMINATION OF THE NOISE LEVEL IN DOPPLER SPECTRA
P. H. Hildebrand and Sekhon 11 Sep. 1973 20 p refs Sponsored in part by United Airlines Foundation Prepared in cooperation with Illinois Inst. of Technol.
(Grant NSF GA-38109)
(TR-32) Avail: NTIS HC $3.00

A method is described for the objective determination of the noise level in Doppler spectra. The method makes use of physical properties of white noise and is suitable for automatic computation. Author

N74-10156# Physics Lab. RVO-TNO, The Hague (Netherlands).
MEASUREMENT OF AMPLITUDE SCINTILLATION ON A RADIOLINK VIA THE UHF TACSATCOM SATELLITE LES-6
P. J. Jansen May 1973 33 p refs In DUTCH; ENGLISH summary
(Ph.L.1973.21) Avail: NTIS HC $3.75

Results of measurements on the amount of amplitude scintillation present on the beacon signal of the geostationary UHF satellite LES-6 are presented for the year 1970. The results are presented in a table giving the cumulative distribution of the scintillation per month and in a number of histograms representing the distribution of the scintillation over the day. The measurements confirm that communication between ground stations on 52 deg latitude via geostationary UHF satellite is hardly affected by amplitude scintillation. Author

N74-10157# Physisch Laboratorium RVO-TNO, s-Gravenhage (Netherlands).
SAMPLING FREQUENCIES IN AN ACTIVE SONAR NORMALIZATION SYSTEM
W. J. P. A. Verbeek Jun 1973 32 p refs
(Ph.L.1973.26) Avail: NTIS HC $3.75

The reverberation in the received signal of a C.W. sonar system is regarded as a Rayleigh distributed colored noise process with slowly varying RMS values. Normalization begins with the taking of the logarithm after which the sum of lognoise is left with zero mean and constant variance and a slowly changing trend. Possible echoes belong to the lognoise part, which must be isolated by means of a linear digital filter. The report is confined to a filter in which the lognoise is being approximated by white noise. The effect of lowering sample frequencies has been studied in terms of signal to lognoise ratio and trend estimation error, which is equivalent to a wrong detection threshold level. In the course of the investigation the autocorrelation function and spectral density of the lognoise process have been determined. Author

N74-10158# European Space Research and Technology Center, Toulouse (France). Meteosat Project Office.
SOME ASPECTS ON THE IMPLEMENTATION OF AN EXPERIMENTAL SPACE TO SPACE LINK FROM A LOW ORBITING SATELLITE TO METEOSAT
G. H. Dieterle 1973 6 p Presented at the Intern. Symp. on Meteorol. Satellites, Paris, 21-24 May 1973
Avail: NTIS HC $3.00

The results of preliminary system studies on a data link between a polar orbiter relayed through the geostationary satellite Meteosat to the central ground station are summarized. The impact on the communications subsystem of Meteosat and on

the low orbiting spacecraft is assessed for rates between 0.1 and 2.4 kbits/sec. ESRO

N74-10159# Army Medical Research Lab., Fort Knox, Ky.
SPEECH INTELLIGIBILITY TESTING WITH THE MODIFIED RHYME TEST IN AVIATION TYPE NOISE Interim Report
James D. Mosko 30 Mar. 1973 13 p ref
(DA Proj. 3A0-61102-B-71P)
(AD-765470; USAMRL-1027) Avail: NTIS CSCL 17/2

Twenty-eight young adult male subjects listened to several versions of a Modified Rhyme Test (MRT) at three different S/N ratios and three levels of background noise. The average percent correct data were evaluated in terms of ear receiving signals, noise level, and S/N ratio. The data indicate an appropriateness of the MRT paradigm for evaluating the auditory capabilities of military personnel. (Modified author abstract) GRA

N74-10160# Technology Service Corp., Santa Monica, Calif.
PHASE LOCKED LOOP PERFORMANCE FOR DOPPLER FLYBY TRACKING
Jerome E. Sacks and William B. Kendall Mar. 1973 53 p refs
(Contract N00014-71-C-0033; NR Proj. Q468-13)
(AD-765746; TSC-PD-067-14) Avail: NTIS CSCL 17/3

The ability of the phase-locked loop to track a Doppler flyby signal is determined in terms of loop parameters and signal parameters. The signal under consideration is a pure sinusoid transmitted from an object traveling in a straight-line constant-velocity path past a stationary receiver. Loop performance bounds are estimated analytically, and then tested by computer simulation of the nonlinear error equations. Both second and third-order loops are examined, and the region where the third-order loop significantly increases performance as compared to the second-order loop is determined. Author (GRA)

N74-10161# Calspan Corp., Buffalo, N.Y.
PROPERTIES OF UNIFORM COHERENT FREQUENCY-JUMP WAVEFORMS
A. F. Culmone Apr. 1973 45 p Prepared for Lincoln Lab., MIT
(Contract F19628-73-C-0002; DA Proj. 7X2-63304-D-215)
(AD-766234; ESD-TR-73-230; CALSPAN-TD-5048-S-7) Avail: NTIS CSCL 17/9

A frequency-jump burst waveform is a sequence of pulses each having the same complex envelope but a different center frequency. When transmitted and received coherently, such a sequence has a range resolution which corresponds to the total bandwidth of the waveform, which may be much greater than that of the receiver IF and video circuitry. Frequency-jump burst waveforms which consist of linear FM pulses uniformly spaced in time and center frequency are considered. Their resolution and ambiguity properties are derived and certain error sources analyzed. In particular, waveforms which are implementable in TRADEX are proposed and evaluated. Author (GRA)

N74-10162# Army Electronics Command, Fort Monmouth, N.J.
FIELD TEST OF A NEAR REAL-TIME IONOSPHERIC FORECASTING SCHEME (500 km)
George E. Krause, Richard J. DAccardi, and Edwin L. Roswell, III Aug. 1973 67 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-766676; ECOM-4145) Avail: NTIS CSCL 20/14

The US Army Electronics Command is developing a system to provide tactical communicators with forecasts, in near real-time, of ionospheric conditions pertinent to HF communications. To do this, vertical incidence (VI) ionospheric data was used to predict Maximum Observed Frequencies (MOF) over a 445 km path. Vertical incidence and oblique incidence (OI) maximum observed frequency data were gathered at the terminals of the path between Fort Monmouth, New Jersey, and Camp Drum, New York. A statistical analysis of the data showed the VI data to be a poor approximation to the OI data. Further, results show that using an obliquity factor based upon the secant law applied to VI data taken at an end point failed to compensate for the observed differences between OI and VI data. An obliquity function was derived, however, which did compensate for these differences. MOF forecasts based upon the model of Ames-Egan, are given for 10, 30, 60, and 120 minutes in advance. Author (GRA)

N74-10163# Army Electronics Command, Fort Monmouth, N.J.
FIELD TEST OF A NEAR REAL-TIME IONOSPHERIC FORECASTING SCHEME (200 km)
George E. Krause, Richard J. DAccardi, and Edwin L. Roswell, III Aug. 1973 53 p refs
(DA Proj. 1H6-62701-A-448)
(AD-766675; ECOM-4144) Avail: NTIS CSCL 20/14

Ionospheric sounder stations were set up at Fort Monmouth, NJ and Aberdeen Proving Ground, Maryland to form the terminals of a nominal 200. km path. Data were taken at each terminal in the vertical incidence (VI) mode and between the terminals in the short-path oblique incidence (OI) mode. A statistical model, previously developed for analysis of short-path ionospheric MOF data, was used to show that there was no significant difference between the short-path OI and VI data. The VI data was used in a near real-time forecasting scheme to provide short-path OI predictions 10, 30, 90, and 120 minutes in advance. Predictions were compared to observed OI data. Author (GRA)

N74-10164# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DECODING OF CYCLIC CODES
V. D. Kolesnik and E. T. Mironchikov 9 Jul. 1973 394 p refs Transl. into ENGLISH of the pub. "Dekodirovanie Tsiklicheskikh Kodov" USSR, 1968 p 1-251
(AF Proj. 4519)
(AD-765934; FTD-HC-23-1783-72) Avail: NTIS CSCL 09/4

The report is a Russian translation devoted to methods of construction and decoding of cyclic correction codes. The properties of linear cyclic codes are considered in detail and new results on construction and analysis of the properties of such codes are presented. Basic methods of decoding, using the algebraic properties of codes, are outlined as follows: A method based on use of linear multistage filters and a selector; A method based on the properties of symmetry of linear codes; A method of direct and step decoding for Bose-Chaudhuri-Hockquenghem codes. Majority decoding, which has a very simple technical realization, is considered in detail. Corresponding codes and decoding schemes based on the apparatus of finite projective geometries are described. The book is intended for scientific researchers, engineers and students, working in the field of digital data transmission through noisy communications channels, as well as mathematicians who are interested in the use of algebraic methods. GRA

N74-10165# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A LOW COST TELEMETRY SYSTEM Final Invention Report
Robert B. Givens and Richard L. Hudson 7 Aug. 1973 5 p Sponsored by NSF
(PB-222403/8; NSF-73-57-GI-12) Avail: NTIS HC $3.00 CSCL 09F

The subject invention relates to a portable, lightweight, low power, telemetry system for use in small drone aircraft of the type used by hobbyists. Such a system greatly expands the capabilities of conventional radiosonde equipment by allowing more data channels to be included with minimal increase in weight and complexity. The instant system uses PPM-FM telemetry (pulse position modulation + or - frequency modulation) with the desired information being encoded, modulated, then transmitted by use of a standard of FM transmitter. GRA

N74-10166# Mitre Corp., Bedford, Mass.
RADAR CROSS SECTION OF THICK DIPOLES
P. C. Waterman Jun. 1973 86 p refs
(Contract F19628-73-C-0001; AF Proj. 4140)
(AD-766649; MTR-2555; ESD-TR-73-131) Avail: NTIS CSCL 17/9

Many measurements and computations are available for the radar cross section of thin wire dipoles. Results for thick wires (diameter/length approximately + or - or < 0.1), however, as well as for the cross-polarized case, are virtually non-existent.

In view of this, some representative calculations were performed and tabulated using wires in the range 0.1 approximately - or + or < diameter/length approximately - or + or < - 0.3, for both polarizations. Author (GRA)

N74-10167# Army Strategic Communications Command, Fort Huachuca, Ariz.
USASTRATCOM DESIRED CAPABILITY LIST
1 Aug. 1973 41 p refs
(AD-766281) Avail: NTIS CSCL 17/2

The purpose of this document is to serve as an interface tool between USASTRATCOM and the R and D community providing those items and ideas that USASTRATCOM uses. Both government and industry Research and Development could better support STRATCOM if they had a clearer understanding of STRATCOM's needs. This document, The USASTRATCOM Desired Capability List, (DCL) constitutes the assembled, published formal statement of future requirements as currently viewed by the STRATCOM system operator. The DCL is planned to provide an effective tool in forging the communications channel with the research community that should materially assist in the selection of research objectives and aims because each item is generated by a user problem and reviewed and validated by senior communicators. Author (GRA)

N74-10168# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
ENCODING TECHNIQUES FOR CONTINUOUS RANDOM SIGNALS Final Report, 1 Jul. 1969 - 30 Jun. 1973
Peter Elias 15 Aug. 1973 8 p refs
(Contract DAHC04-69-C-0042)
(AD-766273; AROD-8143-3-RT) Avail: NTIS CSCL 09/4

Research on two techniques is very briefly explored to study the simple encoding of signals. (1) A low-noise feedback channel was used to improve the performance of an analog communications scheme in the presence of additive noise in the forward path. (2) Quantization of monotone functions in one dimension and in many dimensions were explored and previous results were extended. (Modified author abstract) GRA

N74-10169# Ohio State Univ., Columbus. ElectroScience Lab.
BILINEAR SURFACE REPRESENTATION OF RADAR SCATTERING FOR AIRCRAFT
J. S. Chahal and L. J. White Jul. 1973 82 p refs
(Grant AF-AFOSR-1710-69; AF Proj. 9769)
(AD-766320; ESL-2768-10; AFOSR-73-1528TR) Avail: NTIS CSCL 17/9

Previous research has demonstrated the feasibility of using multiple low frequency radar returns for aircraft target classification. The surfaces corresponding to this aircraft data in frequency space have been represented by a bilinear approximation. This surface representation has allowed the identification of the regions where two surfaces might intersect, and other regions where classification becomes difficult. Several classification methods are investigated using the bilinear surface approximation, and the results of a simulation study are reported. Author (GRA)

N74-10170# Raytheon Co., Wayland, Mass. Equipment Development Labs.
SOLID STATE PREDETECTION COMBINER Final Technical Report, Oct. 1972 - May 1973
Manfred G. Unkauf Griffiss AFB, N. Y. RADC Jul. 1973 69 p refs
(Contract F30602-73-C-0005)
(AD-766280; RADC-TR-73-190) Avail: NTIS CSCL 17/2

A new predetection diversity signal combining algorithm is described which provides near optimum combiner weighting in the presence of both signal distortion and noise. An implementation of this algorithm is described using self-calibrating feedback techniques in a Government-furnished predetection combiner. Both contractor laboratory results and Government field tests over the RADC Troposcatter Experimental Range are presented to demonstrate the various improvements achievable with the additional signal distortion weighting algorithm. Author (GRA)

N74-10171# Syracuse Univ., N.Y. Dept. of Electrical and Computer Engineering.
SPECIAL PROGRAMS FOR ANALYSIS OF RADIATION BY WIRE ANTENNAS Interim Report
Bradley J. Strait, Tapan Sarkar, and Dah-Cheng Kuo 1 Jun. 1973 78 p refs
(Contract F19628-73-C-0047; AF Proj. 5635)
(AD-766252; AFCRL-TR-0399-73; SR-1) Avail: NTIS CSCL 09/5

Two user-oriented computer programs are presented and described. The first is suitable for handling efficiently typical analysis and design problems involving linear arrays of parallel thin-wire antennas. The second is designed to enable efficient analysis of radiation from vertical wire antennas over systems of radial ground wires. Examples are given to illustrate various applications of both programs. Special attention is devoted to use of the first program together with a standard optimization procedure to design linear arrays of wire elements with unequal spacings and/or unequal wire lengths. Author (GRA)

N74-10886 Joint Publications Research Service, Arlington, Va.
GRAVITATIONAL WAVES PROPOSED FOR COMMUNICATING WITH OTHER WORLDS
V. B. Kudrin *In its* Transl. from Priroda, No. 6, 1973 (JPRS-60251) 11 Oct. 1973 p 4-5 Transl. into ENGLISH from Priroda (Moscow), no. 6, 1973 p 98-99 (For availability see N74-10884 01-34)

N74-10452 Institut Franco-Allemand de Recherches, St. Louis (France).
STATE-OF-THE-ART OF TELEMETRY DATA TRANSMISSION FROM HIGHLY ACCELERATED PROJECTILES [ENTWICKLUNGSSTAND DER DATENTELEMETRIE AUS HOCHBESCHLEUNIGTEN GESCHOSSEN]
B. Koch *In its* Papers on Ballistics and Phys. of Transience 1973 p 296-315 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

N74-10453 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRY TRANSMITTER FOR DATA TRANSMISSION FROM SMALL AND MEDIUM CALIBER PROJECTILES IN ACCELERATION RANGE FROM 5000 TO 100000 Q [MESSWERTSENDER ZUR DATENUEBERTRAGUNG AUS GESCHOSSEN KLEINER UND MITTLERER KALIBER FUER DEN BESCHLEUNIGUNGSBEREICH VON 5000 BIS 100000 Q]
G. Schultze *In its* Papers on Ballistics and Phys. of Transience 1973 p 316-342 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N74-10172 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL LINE STORE STANDARDS CONVERSION: DETERMINATION OF THE OPTIMUM INTERPOLATION APERTURE FUNCTION
G. M. LeCouteur Oct. 1973 17 p refs
(BBC-RD-1973/23) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A series of subjective tests are reported with the aim of exploiting the extreme flexibility which can be built into digital linestore converters. This report presents the experimental results and concludes that satisfactory performance is obtained using an interpolation aperture function formed from four ordinates, and that this function is adequately described in a digital system by 36 coefficients each represented in magnitude by a fourbit binary number together with one extra bit for coefficient polarity. Author

N74-10173 Post Office Research Dept., London (England).
A PSEUDO-RANDOM SEQUENCE BINARY-DIGIT GENERATOR AND ERROR DETECTOR FOR DIGITAL SPEEDS 10 KBIT/S TO 260 MBIT/S

and F. A. Graves 27 Apr. 1972 19 p refs
(RR-287) Copyright. Avail: Issuing Activity

A design of pseudo-random sequence binary digit generator has been developed which provides a non-return to zero repetitive pattern of 1023 bits of a rate variable between 10 kbit/s and 260 Mbit/s. The generator, and an associated error detector, form a test set for assessing the performance of digital transmission systems, and means are provided on the generator for the deliberate violation of a known bit in the sequence to test the generator and detector back-to-back. The detector indicates bit errors in the received pattern without the need for frame synchronization from the generator. Integrated logic circuits are extensively used and their limitations in the maximum operating speed of the equipments are discussed. Author

N74-10174*# Clemson Univ., S.C. Dept. of Electrical and Computer Engineering.
ON THE PERFORMANCE OF BLOCK CODES Semiannual Status Report
H. J. Helgert Jul. 1973 58 p
(Grant NGR-41-001-036)
(NASA-CR-132843) Avail: NTIS HC $5.00 CSCL 09B

It is important to define and evaluate measures which incorporate most, if not all, of the quantities affecting the overall system reliability. For the simple types of block codes normally employed in space communication systems, the complexity of the encoder and decoder is of little consequence, since the use of integrated circuit technology allows the construction of the basic components in an inexpensive fashion. The complexity is essentially independent of the particular code-decoder used. The processing speed is generally a function of the type of logic used and the technology in the construction of the integrated circuits. Author

N74-10175*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
ANALYSIS AND SYNTHESIS OF DISTRIBUTED-LUMPED-ACTIVE NETWORKS BY DIGITAL COMPUTER Final Report, 1 Sep. 1967 - 31 Aug. 1973
Aug. 1973 15 p refs
(Grant NGL-03-002-136)
(NASA-CR-135948) Avail: NTIS HC $3.00 CSCL 09B

The use of digital computational techniques in the analysis and synthesis of DLA (distributed lumped active) networks is considered. This class of networks consists of three distinct types of elements, namely, distributed elements (modeled by partial differential equations), lumped elements (modeled by algebraic relations and ordinary differential equations), and active elements (modeled by algebraic relations). Such a characterization is applicable to a broad class of circuits, especially including those usually referred to as linear integrated circuits, since the fabrication techniques for such circuits readily produce elements which may be modeled as distributed, as well as the more conventional lumped and active ones. Author

N74-10176*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERCOMPUTER TRANSFER IN FULL PRECISION OF ARBITRARY DATA ON MAGNETIC TAPE EMPLOYING NASTRAN USER TAPE FORMAT
James L. Rogers, Jr. Washington Nov. 1973 47 p refs
(NASA-TM-X-2901; L-9052) Avail: NTIS HC $3.00 CSCL 09B

A description is presented of two new utility programs which implement the transfer, in full precision, of arbitrary data (matrices or tables) between any of the three NASTRAN operative computers without the handling of large card decks. These computers include the CDC 6000 series, the IBM 360-370 series, and the Univac 1100 series. The data may be generated by NASTRAN or by another computer program if the NASTRAN user tape format is employed. Author

N74-10177*# Stanford Research Inst., Menlo Park, Calif.
RESEARCH IN ADVANCED FORMAL THEOREM-PROVING TECHNIQUES Final Report, 1 Jun. 1971 - 31 Jul. 1973
B. Raphael, R. Fikes, and R. Waldinger Aug. 1973 72 p refs
(Contract NASw-2086; SRI Proj. 8721)
(NASA-CR-135840) Avail: NTIS HC $5.75 CSCL 09B

The results are summarised of a project aimed at the design and implementation of computer languages to aid in expressing problem solving procedures in several areas of artificial intelligence including automatic programming, theorem proving, and robot planning. The principal results of the project were the design and implementation of two complete systems, QA4 and QLISP, and their preliminary experimental use. The various applications of both QA4 and QLISP are given. Author

N74-10178*# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
DESIGN OF A MODULAR DIGITAL COMPUTER SYSTEM, DRL 4 Phase 1 Report, 8 Oct. 1971 - 15 Mar. 1972
15 Apr. 1972 258 p refs
(Contract NAS8-27926)
(NASA-CR-123655; FR-72-11-450) Avail: NTIS HC $15.00 CSCL 09B

The design is reported of an advanced modular computer system designated the Automatically Reconfigurable Modular Multiprocessor System, which anticipates requirements for higher computing capacity and reliability for future spaceborne computers. Subjects discussed include: an overview of the architecture, mission analysis, synchronous and nonsynchronous scheduling control, reliability, and data transmission. F.O.S.

N74-10179# RAND Corp., Santa Monica, Calif.
AN INTERIM EMPIRICAL EVALUATION OF ECSS FOR COMPUTER-SYSTEM SIMULATION DEVELOPMENT
Donald W. Kosy Apr. 1973 38 p refs Presented at SIGSIM/NBS Symp. on the Simulation of Computer Systems, Gaithersburg, Md., Jun. 1973
(P-5011) Avail: NTIS HC $4.00 CSCL 09B

For the special case of simulating computer systems, a recent experiment has provided some data on the effect of using different languages. The experiment consisted of programming a small simulation of a hypothetical multiprogrammed computer in ECSS (The Extendable Computer System Simulator), A new experimental language specifically oriented toward simulating computer systems, and recording in some detail the progress of program development. The purpose of the experiment was to determine to what extent the prototype version of ECSS could reduce the time and expense of such simulation projects. Author

N74-10180*# General Research Corp., Arlington, Va.
IMAGE DATA PROCESSING SYSTEM REQUIREMENTS STUDY. VOLUME 2: APPENDIXES Final Report, May 1973 - Aug. 1973
T. Honikman, E. McMahon, E. Miller, L. Pietrzak, and W. Yorsz Oct. 1973 362 p
(Contract NAS5-21920)
(NASA-CR-132853; WGRC-73-3274; CR-1-417) Avail: NTIS HC $20.25 CSCL 09B

Supporting information for the ERS loading study contains computer simulation loading output including printout description, and similar output representing data that include night station contacts. Author

N74-10181# Medical Biological Lab. RVO-TNO, Rijswijk (Netherlands).
A HARDWARE BREAKOUT DEBUGGING AID FOR THE PDP8/1
Floor Anthoni and Adri Hemelaar 1973 9 p ref
(MBL-1973-7) Avail: NTIS HC $3.00

Any standard PDP8/1 computer can be equipped with a hardware breakpoint debugging aid by wiring a comparator module and a control switch panel. This hardware addition matches the contents of the memory address register with the contents of the control switches in order to halt the computer at the selected breakpoint address. Author

N74-10182*# TRW Systems Group, Houston, Tex. Simulation Development Section.
AUTOMATED VERIFICATION SYSTEM USER'S GUIDE
R. H. Hoffman 12 Jan. 1972 78 p refs
(Contract NAS9-12330; Proj. Apollo)
(NASA-CR-115374; TRW-20029-H026-R0-00; TRW-Note-72-FMT-891) Avail: NTIS HC $6.00 CSCL 09B

Descriptions of the operational requirements for all of the

programs of the Automated Verification System (AVS) are provided. The AVS programs are: (1) FORTRAN code analysis and instrumentation program (QAMOD); (2) Test Effectiveness Evaluation Program (QAPROC); (3) Transfer Control Variable Tracking Program (QATRAK); (4) Program Anatomy Table Generator (TABGEN); and (5) Network Path Analysis Program (RAMBLE). Author

N74-10183*# Westinghouse Electric Corp., Baltimore, Md. Defense and Electronic Systems Center.
ADVANCED ON-BOARD PROCESSOR (AOP) Final Report
15 Jun. 1973 40 p
(Contract NAS5-20278)
(NASA-CR-132851) Avail: NTIS HC $4.00 CSCL 09B

Advanced On-board Processor the (AOP) uses large scale integration throughout and is the most advanced space qualified computer of its class in existence today. It was designed to satisfy most spacecraft requirements which are anticipated over the next several years. The AOP design utilizes custom metallized multigate arrays (CMMA) which have been designed specifically for this computer. This approach provides the most efficient use of circuits, reduces volume, weight, assembly costs and provides for a significant increase in reliability by the significant reduction in conventional circuit interconnections. The required 69 CMMA packages are assembled on a single multilayer printed circuit board which together with associated connectors constitutes the complete AOP. This approach also reduces conventional interconnections thus further reducing weight, volume and assembly costs. Author

N74-10184# Logica Ltd., London (England).
DATA REPRESENTATION STUDY Final Report
Oct. 1972 52 p refs
(Contract ESOC-38/71-AR)
(ESRO-CR(P)-282) Avail: NTIS HC $4.75

Large data masses which have to be scanned quickly for significant events, and smaller sets of data for detailed investigations are two areas of data representation discussed. The conclusions are: visual methods of data presentation are preferable to aural methods; suitable display hardware is available, and the design and development of suitable software are the most critical factors in the implementation of a data laboratory system. Working papers on these topics are described and bibliographic technical references are also included. ESRO

N74-10185# Danish Research Centre for Applied Electronics, Copenhagen.
WRLSTS: A COMPUTER PROGRAM FOR PRODUCING AND UPDATING WIRING-LISTS
N. Horstock Dec. 1972 49 p
(ECR-31) Avail: NTIS HC $4.50

The WRLSTS program produces and updates cross-reference wiring lists, which are used during the development and production of electronic instruments. The program accepts wiring data prepared in an easy and understandable format, classifies it, searches for errors, and creates the cross-reference wiring lists. The wiring lists are printed out on the terminal in A3 format with a suitable heading and paging. The program is organized around 5 independent routines: catalog, alternation, block, inspection, and tracing. Their contents are detailed together with the I/O routines, input, data format, and error listing. ESRO

N74-10186# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDYING RELIABILITY OF MAJORITY STRUCTURES WITH RESTORATION
E. M. Mamedli 18 Jun. 1973 20 p refs Transl. into ENGLISH from the publ. "Vychislitelnaya Tekhnika v Mashinostroenii" Baku, Dec. 1969 p 144-155
(AD-765969; FTD-HT-23-344-73) Avail: NTIS CSCL 09/2

An analysis is presented of the majority structures with restoration of the failed elements with a multiplicity of redundancy equal to three. A gain in the reliability of the majority structures is determined with respect to the nonredundancy circuit. Majority structures ensuring certain reliability in the interval of time (0, t) are synthesized at a known rate of failures and restoration of their elements. GRA

N74-10187# Illinois Univ., Urbana. Coordinated Science Lab.
[CONTINUED RESEARCH IN PHYSICAL ELECTRONICS, COMPUTER AND INFORMATION SYSTEMS, AND COMMUNICATION AND CONTROL SYSTEMS] Annual Progress Report, 1 Jul. 1972 - 30 Jun. 1973
R. T. Chien, G. G. Judge, and W. C. Prothe Aug. 1973 359 p refs
(Contracts DAAB07-72-C-0259; N00014-67-A-0305-0021; Grants AF-AFOSR-2210-72; NSF GK-36276)
(AD-765960) Avail: NTIS CSCL 05/2

Contents: Physical electronics: Surface studies, Thin films, Plasma physics, Rarefied gas dynamics, Computational gas dynamics, Semiconductor physics; Computer and information systems: Digital systems; Plasma display/memory research; Photodichroic memory for computer application; Information science; Artificial intelligence; Information retrieval; Communication and control systems: Networks; Control systems. GRA

N74-10188# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
DESIGN AND IMPLEMENTATION OF A MULTI-LEVEL SYSTEM USING SOFTWARE MODULES
L. Robinson Jun. 1973 23 p refs
(Contract F44620-70-C-0107; Grants NSF GJ-32259; NSF GJ-37728)
(AD-766319; AFOSR-73-1525TR) Avail: NTIS CSCL 09/2

A mechanism for holding programs in syntactic form was desired for use by systems which operate on other programs: program verifiers, automatic programming systems, and specialized text editors. The mechanism was designed using the software module specification language of D.L. Parnas, and implemented in SAIL, an Algol-like language on the PDP 10. It is suggested that specifications assist in both the design and implementation process. Author (GRA)

N74-10189# Naval Postgraduate School, Monterey, Calif.
A STUDY INTO THE PROBLEM OF DEADLOCK M.S. Thesis
Leslie Ray Conklin Jun. 1973 53 p refs
(AD-765675) Avail: NTIS CSCL 09/2

The paper presents a study of the problem of system deadlock with emphasis on the allocation of serially reusable resources. The initial area of concentration is on a definition of system deadlock and a presentation of proven methods of handling deadlock. After the discussion of current theory, two major operating systems are examined. An overall description of the functioning of OS/360 is presented followed by a detailed discussion of the procedures used by OS/360 to allocate serially reusable resources. The Michigan Terminal System is then discussed, outlining the techniques of resource allocation employed. The paper is concluded by correlating the methods used in OS/360 with those of MIS. Author (GRA)

N74-10190# Rome Air Development Center, Griffiss AFB, N.Y.
A DATA MANAGEMENT SYSTEM PROBLEM SPECIFICATION MODEL
Gerard T. Capraro Jun. 1973 72 p refs
(AF Proj. 4540)
(AD-766449; RADC-TR-73-193) Avail: NTIS CSCL 09/2

A data management system problem specification model (DMSPSM) is described. The model represents an attempt to show the relationships of the main factors that should be considered when designing or choosing a data management system (DMS) for a particular data problem. The main factors that should be considered for a DMSPSM are: (a) the input, output, and maintenance requirements of the data base; (b) a specification of the data problem; (c) a logical file representation of the data base; (d) a complete description of the data management systems to be considered; and (e) a detailed description of the computer system(s) that the DMS is to reside in. The main emphasis of this model (DMSPSM) is that the data problem description or specification is the basis for developing the output of the model. The output of the model is a solution to a data management problem as described by the user(s) of the data base. (Modified author abstract) GRA

N74-10191# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

IMPLICATIONS OF A VIRTUAL MEMORY MECHANISM FOR IMPLEMENTING PROTECTION IN A FAMILY OF OPERATING SYSTEMS Ph.D. Thesis
William Robert Price Jun. 1973 252 p refs
(Contract F44620-70-C-0107; Grant NSF GJ-32259; AF Proj. 9769)
(AD-766292; AFOSR-73-1522TR) Avail: NTIS CSCL 09/2

The dissertation proposes the design of a virtual memory mechanism. The proposed virtual memory is unusual in that it advocates the use of restricted address spaces and supports large programming systems by providing a means for programs to transfer control from one address space to another. The goals of the virtual memory design are: To increase program reliability; to provide all necessary system protection; to aid in more efficient memory management. The virtual memory design is intended for use in a family of hierarchically structured operating systems. The position of the virtual memory in the hierarchy assists in operating system reliability and provides a foundation for implementing a broad class of protection policies. A method of verifying software design is demonstrated and applied to the virtual memory design. Several suggestions for more suitable virtual memory hardware are provided. Author (GRA)

N74-10249* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION AS A COMPUTER DESIGN AID
J. E. Weatherbee (Computer Sciences Corp., Huntsville Ala.), D. S. Taylor (Computer Sciences Corp., Huntsville, Ala.), and B. C. Hodges *In its* Space Simulation, 7th 1973 p 231-249 refs (For availability see N74-10232 01-11)
CSCL 09B

N74-10882 Joint Publications Research Service, Arlington, Va.
EXHIBIT OF ELECTRONIC COMPUTERS IN PLOVDIV
I. Beteva *In its* Transl. on Eastern Europe: Sci. Affairs, No. 359 (JPRS-66224) 9 Oct. 1973 p 6-7 Transl. into ENGLISH from Otechestven Front (Sofia), 8 Sep. 1973 p 1 (For availability see N74-10880 01-34)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N74-10192 Department of Energy, Mines and Resources, Ottawa (Ontario). Earth Physics Branch.
AN ALTERNATING FIELD DEMAGNETIZER FOR ROCK MAGNETISM STUDIES
J. L. Roy, J. Reynolds, and E. Sanders 1973 11 p refs *Its* Publ. of the Earth Phys. Branch, Vol. 44, No. 3
Copyright. Avail: Issuing Activity

The design of solenoids with inside radii of 4 or more cm and capable of producing alternating fields of a few thousand oersted is given. It is shown that, to produce such high fields, large wire sizes are required, the ohmic resistance being the main determining factor of the field attainable. A multilayer solenoid designed to produce fields of 3,800 oersted peak on an imput of 230 volts is described. Practical considerations such as field uniformity, core sizes, heating problems, high voltages and methods of preventing anhysteretic remanent magnetization are discussed. The circuit, the semi-automatic operation and other details of an apparatus consisting principally of a solenoid, a tumbler and an induction coil are given. Author

N74-10193 British Broadcasting Corp., Kingswood (England). Research Dept.
A UHF RUGGEDISED LOG-PERIODIC AERIAL
J. L. Riley Oct. 1973 15 p refs
(BBC-RD-1973/24) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

A ruggedized UHF log periodic aerial covering bands 4 and 5 and suitable for both receiving and transmitting purposes has been developed. There are two versions of the aerial, one with an air spaced main feeder boom and the other with a dielectric loading on the aerial boom. Some of the more important design factors are described in detail. The side and back-lobe radiation is more than 23 db down on the main lobe at all frequencies. The aerial effective gain is about 8 db relative to a half-wave dipole. Author

N74-10194* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTROLLED OSCILLATOR SYSTEM WITH A TIME DEPENDENT OUTPUT FREQUENCY Patent
Robin A. Winkelstein, inventor (to NASA) Issued 9 Oct. 1973 8 p Filed 27 Sep. 1972 Supersedes N73-12215 (11 - 03, p 0273) Sponsored by NASA
(NASA-Case-NPO-11962-1; US-Patent-3,764,933; US-Patent-Appl-SN-292681; US-Patent-Class-331-1A; US-Patent-Class-331-4; US-Patent-Class-331-14; US-Patent-Class-331-17; US-Patent-Class-331-18; US-Patent-Class-331-178) Avail: US Patent Office CSCL 09E

A controlled oscillator system is presented for providing an output with a frequency which changes with respect to time and with a phase which is within established phase error limits. The system includes a frequency synthesizer with a symmetrical search oscillator, capable of tuning the output with a range of + or - 100 Hz about any fixed frequency to which the synthesizer is set. For a tuning range of 200 Hz (+ or - 100 Hz) an expanded search oscillator output of a frequency range of 4 MHz (from 1 MHz to 5 MHz) is provided. A counter counts continuously the expanded output cycles and at each of fixed sampling intervals, for every 0.1 second, the count or number accumulated in the counter is read out. The sample number is compared with a theoretical number which should be present in the counter at the particular sampling instant for proper synthesizer's output frequency and phase.
Official Gazette of the U.S. Patent Office

N74-10195* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRON BEAM CONTROLLER Patent
Henry G. Kosmahl, inventor (to NASA) Issued 9 Oct. 1973 5 p Filed 27 Jun. 1972 Supersedes N72-28227 (10 - 19, p 2535)
(NASA-Case-LEW-11617-1; US-Patent-3,764,850; US-Patent-Appl-SN-266832; US-Patent-Class-315-5.38; US-Patent-Class-315-5.35) Avail: US Patent Office CSCL 09C

An electron beam device which extracts energy from an electron beam before the electrons of the beam are captured by a collector apparatus is described. The device produces refocusing of a spent electron beam by minimizing tranverse electron velocities in the beam where the electrons, having a multiplicity of axial velocities, are sorted at high efficiency by collector electrodes. Official Gazette of the U.S. Patent Office

N74-10196 Washington Univ., St. Louis, Mo.
AN INVESTIGATION OF FLAT PANEL DISPLAYS Ph.D. Thesis
Victor Henry Nettle, Jr. 1972 102 p
Avail: Univ. Microfilms Order No. 73-11821

Flat panel displays are investigated and their characteristics are assessed. Theoretical and experimental results obtained from a real-time light emitting diode (LED) display having dimensions 32 x 32 on 0.1 inch centers are presented. Investigation of light emitting diode characteristics indicates that pulse width modulation is required to insure linear operation at the current densities normally encountered in such an array having gray scale. It is demonstrated that in normal operation a matrix LED oscilloscope requires more columns than rows in order to obtain uniform resolution of a typical displayed waveform.
Dissert. Abstr.

N74-10197 Illinois Inst. of Tech., Chicago.
FUNDAMENTAL ENERGY RELATIONSHIPS IN CLASS C TRANSISTORIZED FREQUENCY MULTIPLIERS Ph.D. Thesis
George Arnold Olson 1972 77 p
Avail: Univ. Microfilms Order No. 73-12226

Class C transistor frequency multipliers do not exhibit the stability that their vacuum tube counterparts do. Spurious frequency production, oscillation, and transistor failure occur with an undesirable incidence. Transistor collector-base capacitance is examined in the role of input-output coupling agent by a computer program developed to generate numerical solutions to the integral of a nonlinear expression. A mathematical solution utilizing a series approximation is used to corroborate the results of the computer program. A simple but effective solution to the parametrically-generated problem can be found in the form of a semiconductor diode, the specifications for which are presented. Dissert. Abstr.

N74-10198 Minnesota Univ., Minneapolis.
IMPEDANCE AND NOISE MEASUREMENT OF DOUBLE INJECTION SPACE CHARGE LIMITED DIODE Ph.D. Thesis
Tseng-Nan Tsai 1972 110 p
Avail: Univ. Microfilms Order No. 73-10647

The dc current-voltage characteristics, the small signal ac admittances, and the high frequency noise of the devices were measured and compared with the theory. It was found that, for long devices, the impedance of the p-i junction and the impedance of the n-i junction were negligible. For short devices, the impedance of p-i junction and the impedance of the n-i junction were comparable to the impedance due to the space charge region, i.e., impedance of the i-region and so they were taken into account in getting the ac admittance formula. For the explanation of the thermal noise behavior of the device, it was also found that the shot noises due to both the p-i junction and the n-i junction need to be taken into account although both were shorted respectively by the p-i junction admittance and the n-i junction admittance. Large signal behavior of several devices biased at the relaxation regime were also studied to determine the nonlinearity of the device. Dissert. Abstr.

N74-10199# National Research Council of Canada, Ottawa (Ontario).
INVESTIGATION OF SILICON PHOTOELECTRIC CELLS AS PRECISION PHOTODETECTORS
N. Muroi and M. Ishino 1973 24 p refs Transl. into ENGLISH from Shomei Gakkai Zasshi (Japan), v. 52, no. 4, 1968 p 20-26
(NRC-TT-1686) Avail: NTIS HC $3.25

The use of silicon photoelectric cells as photodetectors is evaluated. It is found that silicon photoelectric cells offer good, stable photodetectors, but in view of the energy gap there are still more effective photoreceptors than silicon photoelectric cells. For example, there are monocrystal photoelectric cells and multilayer photoelectric cells of the monocrystals GaAs, InP, CdTe and CdSe. Author

N74-10200*# Westinghouse Research Labs., Pittsburgh, Pa.
MILLIMETER WAVE PUMPED PARAMETRIC AMPLIFIER Patent Application
Lawrence E. Dickens, inventor (to NASA) Filed 2 Oct. 1973 18 p
(Contract NAS5-20149)
(NASA-Case-GSC-11617-1; US-Patent-Appl-SN-402865) Avail: NTIS HC $3.00 CSCL 09A

A millimeter wave parametric amplifier structure and a varactor diode mounting structure are presented including a housing with a pump frequency waveguiding channel and an intersecting signal frequency transmission line. The transmission line has a center conductor portion which protrudes into the pump channel. A portion of the housing forms the outer conductor of the transmission line. A pair of uncased varactor diode chips within the channel are stacked and connected in series across the waveguiding channel and are connected in parallel with respect to the inner and outer conductors of the signal transmission line. An adjustable stub means protrudes into the waveguiding channel adjacent to the stacked varactor diode chips and defines a capacitive gap across the channel for series resonating the diode chips at an idler frequency. The stub means is located close to the stacked diode chips to provide a short return path for idler current generated by the diodes. NASA

N74-10201*# Princeton Univ., N.J. Dept. of Astrophysical Sciences.
STUDY OF MAGNETIC PERTURBATIONS ON SEC VIDICON TUBES Final Report
D. C. Long, P. Zucchino, and J. Lowrance 24 Aug. 1973 69 p refs
(Contract NAS5-23254)
(NASA-CR-132836) Avail: NTIS HC $5.50 CSCL 09A

A laboratory measurements program was conducted to determine the tolerances that must be imposed to achieve optimum performance from SEC-vidicon data sensors in the LST mission. These measurements along with other data were used to formulate recommendations regarding the necessary telemetry and remote control for the television data sensors when in orbit. The study encompassed the following tasks: (1) Conducted laboratory measurements of the perturbations which an external magnetic field produces on a magnetically focused, SEC-vidicon. Evaluated shielding approaches. (2) Experimentally evaluated the effects produced on overall performance by variations of the tube electrode potentials, and the focus, deflection and alignment fields. (3) Recommended the extent of ground control of camera parameters and camera parameter telemetry required for optimizing the performance of the television system in orbit. The experimental data are summarized in a set of graphs. Author

N74-10202*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW SPEED PHASELOCK SPEED CONTROL SYSTEM Patent Application
Robert W. Fulcher and John Sudex, inventors (to NASA) Filed 27 Sep. 1973 29 p
(NASA-Case-GSC-11127-1; US-Patent-Appl-SN-401466) Avail: NTIS HC $3.50 CSCL 09A

A phaselock speed control system is reported that provides extremely accurate speed control, particularly at low speeds, of a brushless dc motor. The overall speed control system includes a phase comparator which compares a reference frequency signal with an encoder frequency signal. An integrator/converter unit converts the output of the phase comparator into an analog error voltage which is compensated and biased to derive a bi-directional error signal for further combination with the output from an overspeed control circuit in an operational amplifier to develop the torque polarity and control signal. NASA

N74-10203*# Watkins-Johnson Co., Palo Alto, Calif.
THE DEVELOPMENT OF A MULTI-CATHODE ELECTRON GUN Final Report
Lester A. Roberts 7 Sep. 1973 47 p Prepared for JPL
(Contracts NAS7-100; JPL-952784)
(NASA CR-136034) Avail: NTIS HC $4.50 CSCL 09A

A multicathode electron gun, capable of automatically interchanging cathode structures of a microwave electron tube upon command was developed. This technique extends the life of a microwave electron tube into the range of fifty to one hundred years. The concept consists of mounting a number of cathode structures on a rotating platform. Rotation of the platform moves the different cathodes into operating position. The component tests, construction and operation of the gun are described. F.O.S.

N74-10204*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BIFOCAL DUAL REFLECTOR ANTENNA
B. L. J. Rao Sep. 1973 27 p refs
(NASA-TM-X-70490; X-750-73-263) Avail: NTIS HC $3.50 CSCL 17B

A bifocal dual reflector antenna is similar to and has better scan capability than classical cassegrain reflector antenna. The method used in determining the reflector surfaces is a modification of a design method for the dielectric bifocal lens. The three dimensional dual reflector is obtained by first designing an exact (in geometrical optics sense) two-point corrected two dimensional reflector and then rotating it around its axis of symmetry. A point by point technique is used in computing the reflector surfaces. Computed radiation characteristics of the dual reflector are compared with those of a cassegrain reflector. The results

confirm that the bifocal antenna has superior performance.
Author

N74-10205*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SHAPED CASSEGRAIN REFLECTOR ANTENNA
B. L. J. Rao Mar. 1973 10 p refs
(NASA-TM-X-70491; X-750-73-264) Avail: NTIS HC $3.00 CSCL 17B

Design equations are developed to compute the reflector surfaces required to produce uniform illumination on the main reflector of a cassegrain system when the feed pattern is specified. The final equations are somewhat simple and straightforward to solve (using a computer) compared to the ones which exist already in the literature. Step by step procedure for solving the design equations is discussed in detail. Author

N74-10206*# Radio Corp. of America, Somerville, N.J. Solid State Div.
DEVELOPMENT OF A RUGGEDIZED 20-WATT, 2.3- GIGAHERTZ TRANSISTOR Final Project Report, 10 Nov. 1971 - 31 Jan. 1973
31 Jan. 1973 45 p
(Contract NAS5-21668)
(NASA-CR-132856) Avail: NTIS HC $4.25 CSCL 09A

This program was to develop a ruggedized transistor capable of meeting the following CW objectives at 2.3 gigahertz: a power output of 20 watts, a power gain of 6 db, and an efficiency of 40 percent. Devices developed produced the following CW performance at 2.3 gigahertz: a power output of 23 watts, a power gain of 7.7 db, and an efficiency of 40.0 percent. This performance was achieved with an eight-cell TA8407 transistor design having the following modifications: a thin pellet, high-frequency diffusion, high-level emitter ballasting, an optimized emitter-bonding configuration for uniform power sharing, and a package that provides for some internal matching through the use of distributed line techniques. Author

N74-10207# AEG-Telefunken, Ulm (West Germany). Microwave Tube Dept.
STUDY OF MULTI-STAGE SELF-RADIATING COLLECTOR FOR HIGH-POWER KLYSTRON OR TWT
D. Deml, K. H. Bluhm, and U. Hoppe 1 Dec. 1972 162 p Prepared jointly with Dornier-Werke
(Contract ESTEC-1512/71)
(ESRO-CR(P)-274) Avail: NTIS HC $10.25

A multistage self radiating collector for high power klystron or TWT was studied to find a collector concept which guarantees an overall efficiency of the power amplifier of better than 51%. The investigations concentrated on a TWT with an output power of 400 W at a useful operating bandwidth of 250 MHz. The feasability study of such a collector led to a 5 stage pure electrostatic collector (ES). It was also demonstrated that TEF (tilted electric field) collectors promise higher efficiency figures, but that difficulties exist in realizing such a device in view of the self-radiating collector problem. Ground testing as well as mechanical considerations yield a construction where the real collector is surrounded by a cylinder at ground potential. This cylinder can be vented after the satellite has reached its right position in orbit. Whether or not venting is necessary is dictated by the maximum operating temperature of the collector. A preliminary design is presented. The electrical and thermal analysis as well as the basic mechanical layout are given. Two different mechanical layouts were considered leading to different temperatures of the individual collector stages. Both concepts are shown. ESRO

N74-10208# Defence Research Information Centre, Orpington (England).
PHOTOMETRIC MEASUREMENTS USING IMAGE CONVERTERS
J. Bardes, C. Chancel, P. Jourde et al Jun. 1973 15 p refs Transl. into ENGLISH from Acta Electron. Paris, v. 15, no. 4, 1972 p 351-356
(DRIC-Trans-3221; BR30565) Avail: NTIS HC $3.00

Photometric measurements using image converters imply that the converters obey a number of criteria. A method to verify these criteria is given. A precise calibration of the converters allows the determination of a working range in which the method appears to be easy and fast to use. It is shown that the main limitation is associated with the nonlinear response of the used photographic film. The use of an image converter remains a simple and rapid method for photometric measurements where luminance deviations of the source to be studied remain inferior to 100. ESRO

N74-10209# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et des ses Applications Spatiales.
BIPOLAR TRANSISTOR BURST NOISE AND PHYSICO-CHEMICAL PROCESS-INDUCED DEFECTS. A CORRELATION ANALYSIS Final Report [CORRELATION ENTRE LES DEFAUTS INDUITS PAR LES PROCESSUS PHYSICO-CHIMIQUES D'ELABORATION DES TRANSISTORS BIPOLAIRES ET LEUR BRUIT DE FOND EN CRENEAUX RAPPORT FINAL]
G. Blasquez, A. DeCacqueray, and J. Caminade Oct. 1972 27 p refs In FRENCH
(Contract DRME-71/34.438.00.480.75.01)
(LAAS-Publ-967) Avail: NTIS HC $3.50

A correlation between low frequency burst noise presence and physico-chemical processing of n-p-n Si transistor or linear integrated circuit crystal lattice defects is discussed. The phenomenon appears at the base-emitting junction, frequently at the Si-SiO2 interface, and is due to local current fluctuations at a metal semiconductor contact or from generation recombination. Experiments used Au and Cu additives diffused or diffused-and-trapped. Experimental procedures are detailed, and crystalline defects are evidenced by X ray inspection and chemical attack with Sirtl and Adler reagent. Linear defects, emitter edge dislocations, and dislocation clusters are shown to originate mostly from steep thermal gradients during cooling and high additive concentrations. For future applications, substitution of As to P should yield reduced mechanical lattice constraints and fully automated slow oven extraction should permit burst noise free transistor manufacture. ESRO

N74-10210# Rome Air Development Center, Griffiss AFB, N.Y.
NICHROME RESISTOR PROPERTIES AND RELIABILITY Final Report, Jul. 1970 - May 1973
Clyde H. Lane Jun. 1973 73 p refs
(AD-765534; RADC-TR-73-181) Avail: NTIS CSCL 09/1

A collection of the physical properties of nichrome films is given. Graphs are presented giving property variations as functions of composition, deposition rate, method of deposition, substrate morphology etc. Failure mechanisms such as electromigration interdiffusion, corrosion and electrocorrosion are addressed and specific information is given with regard to real, possible and unlikely mechanisms. The report is intended to give a composite review of nichrome resistor technology from a process and reliability point of view. Author (GRA)

N74-10211# Varian Associates, Palo Alto, Calif.
TRANSMITTER TUBE FOR TROPOSCATTER APPLICATION Final Report, Jun. 1970 - Jul. 1971
A. Goldfinger Jun. 1973 72 p
(Contract DAAB07-70-C-0228; DA Proj. 1X6-64701-D-149)
(AD-765517; ECOM-0228-F-70) Avail: NTIS CSCL 09/1

The program was directed toward further development and testing of a klystron amplifier. The goal was the fabrication and delivery of a practical field transmitter with an overall efficiency of 50%; the transmitter in this case is defined as the klystron tube, focusing mechanism, and cooling system. Efficiency is defined as the RF power output divided by the sum of the power inputs to the klystron amplifier, the focusing mechanism, and the cooling system. (Modified author abstract) GRA

N74-10212# Bendix Corp., Baltimore, Md. Communications Div.
FAST WARMUP QUARTZ REFERENCE OSCILLATOR Final Report, 1 Jun. 1971 - 31 Jan. 1973
Harold M. Greenhouse, Robert L. McGill, and Daniel P. Clark Jun. 1973 115 p refs
(Contract DAAB07-71-C-0265; DA Proj. 1S6-62705-A-058)
(AD-765504; ECOM-0265-F-71; Rept-471-1045-984) Avail: NTIS CSCL 09/1

The report covers the work in developing a miniature fast warmup quartz oscillator for use in planned tactical communication equipment. The report includes design, fabrication, and performance details of such a device. Electrical, thermal mechanical, and microelectronic design criteria are given in sufficient detail to allow trade-offs with respect to performance goals. To keep the size of this stable 5 MHz oscillator within one cubic inch, microelectronic techniques are employed. The resonator is held at its upper turn point and is enclosed in a specially designed isothermal enclosure. The enclosure is held at a constant uniform temperature by a proportional temperature control circuit so that the enclosure is the oven for the resonator. Located on top of the enclosure, and maintained at a constant temperature, are the oscillator, heating transistors, the temperature controller for the enclosure, and a second control circuit. (Modified author abstract) GRA

N74-10213# Naval Postgraduate School, Monterey, Calif.
STUDY OF PbSnTe SINGLE HETEROJUNCTION DIODES M.S. Thesis
Gordon Lee Smith Jun. 1973 90 p refs
(AD-765697) Avail: NTIS CSCL 09/1

The electrical and photovoltaic properties of single heterojunction (SH) Pb(1-x)Sn(x)Te diodes have been studied. SH diodes were fabricated by sequential depositions of p-type Pb(0. 86)Sn(0.14)Te using stoichiometric source material and n-type Pb(0.80)Sn (0.20)Te using metal rich source material. At T = 77K, their energy gaps are 0.136 eV and 0.103 eV, respectively. SH diodes of good rectification with RoA products ranging from 3.5 to 18.6 have been obtained. Operated at 100K, 500K black body photovoltaic responses up to 0.2 volt/watt has been obtained. The current-voltage characteristics have been studied theoretically based on both the Anderson Diffusion Model and the Thermionic Emission Model. Using Anderson's model, and assuming delta E(c) = 0, constant electron affinity across the junction, fair agreements have been found between measurements and theoretical calculations. Author (GRA)

N74-10214# Naval Postgraduate School, Monterey, Calif.
SLOT LINE FERRITE ISOLATOR M.S. Thesis
Imon Lester Pilcher Jun. 1973 46 p refs
(AD-765668) Avail: NTIS CSCL 09/1

A slot line isolator configuration is investigated experimentally. The configuration is analyzed using perturbation theory. Theoretical results obtained from a computer program based on the analysis are compared with the experimental measurements. Author (GRA)

N74-10215# Owens-Illinois, Inc., Toledo, Ohio. Electro-Optical Development Dept.
THREE-COLOR PLASMA PANEL DISPLAY DEVICE Final Report, 30 Jun. 1970 - 30 Sep. 1972
H. J. Hoehn, R. A. Martel, J. D. Schermerhorn, W. D. Petty, and H. G. Slottow May 1973 184 p refs
(Contract DAAB07-70-C-0243)
(AD-766287; ECOM-0243-F-70) Avail: NTIS CSCL 09/5

The objectives of the program were to design, fabricate, and evaluate a plasma display panel having 3-color capability and to investigate and develop a technique for operating such a device with three levels of intensity. Red, blue, and green-emitting phosphors that respond to vacuum-UV excitation were selected for use in the multi-color plasma panel. Six panels with 60 total lines per inch line-density, 512 x 512 multi-color resolution-elements and a display area of 17 in x 17 in were fabricated and tested. An electronic drive system capable of operating these panels was designed and constructed. Three levels of intensity could not be achieved on the color-panels because of certain characteristics of the UV-emitting gases. Multi-state operation was demonstrated on a conventional 33 line-per-inch, non-phosphor, plasma display panel. (Modified author abstract) GRA

N74-10216# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
DEFECT LEVELS IN NEUTRON-IRRADIATED GaAs SCHOTTKY DIODES AND LASER DIODE DEGRADATION Physical Sciences Research Papers
Jacques E. Ludman 31 May 1973 84 p refs
(AD-766245; AFCRL-TR-73-0344; AFCRL-PSRP-550) Avail: NTIS CSCL 09/1

GaAs Schottky and laser diodes are irradiated with high energy neutrons and the resultant trap and defect structure analyzed. The Schottky diodes are irradiated with a clean high-energy neutron beam from a Van de Graaff accelerator, and the laser irradiation is done in a nuclear reactor. The defect structure is shown to consist of energetically discrete trap levels, but the levels are found not to operate independently. A new defect model is proposed based on coupled defect levels and is shown to be in good agreement with the observations. On the basis of this model, values for the discrete trap levels are determined. Experimentally, Schottky diodes are cooled to temperatures in the region 78K, to 178K, the back bias is turned off and on again, and the capacitance versus time (capacitance decay) is monitored. These measurements are used to derive the activation energies of the trap levels. Trap levels are found at 175, 220, 325, 380 and 460 mV below the conduction band. Several general numerical techniques are developed for the purpose of fitting experimental data to both the independent-level and coupled-level decay models. Author (GRA)

N74-10217# Michigan Univ., Ann Arbor. Electron Physics Lab.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TRANSFERRED-ELECTRON AMPLIFIERS
A. K. Talwar Dec. 1972 257 p refs
(Contract F30602-71-C-0099)
(AD-757572; RADC-TR-72-315; TR-127) Avail: NTIS CSCL 09/1

The study is an attempt to understand the behavior and potential of transferred-electron amplifiers. Both subcritically doped as well as supercritically doped devices are considered. A large-signal analysis of subcritically doped, negative conductance-type devices is developed. The analysis is one-dimensional and includes the effects of diffusion, where the diffusion coefficient is dependent upon the electric field. First-order nonlinear equations involving the dc and RF electric fields in the material are obtained for given dc and RF currents driven through the diode. The equations are solved on a digital computer and the results are presented. Various dc and RF characteristics of the diodes are examined. The effects of diffusion, bandwidth considerations, the effects of bias, temperature effects and the effects of doping density are discussed. The experimental study of stable negative conductance amplifiers is presented. GRA

N74-10218# Army Foreign Science and Technology Center, Charlottesville, Va.
HANDBOOK ON GAS-FILLED TUBES
D. S. Gurley 30 Jun. 1973 221 p refs Transl. into ENGLISH of the publ. "Spravochnik po Ionnym Priboram" Kiev, Tekhn., 1970
(AD-765971; FSTC-HT-23-327-73) Avail: NTIS CSCL 09/1

Data are presented on the parameters, types of systems and operating conditions of the most widespread domestically produced gas-filled tubes. The principles of operation and construction of each class of tube is briefly described. Circuit configurations are given for certain tubes. Data are given on tubes applicable to electronics and radio engineering (stabilitrons, thyratrons), industrial power rectification equipment (mercury-filled tubes), domestic and industrial illumination (lamps of types LD, PRK, DRSh, etc.) and computer and other fields of technology (decatrons, nuclear radiation counters and the like). Author (GRA)

N74-10219# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CHANGE IN REFLECTION COEFFICIENT INDUCED BY A SPOT ON THE SURFACE OF A DIELECTRIC INSIDE A RECTANGULAR WAVEGUIDE Physical Sciences Research Papers
Ronald L. Fante 18 Jun. 1973 23 p refs
(AF Proj. 5635)
(AD-766211; AFCRL-TR-73-0365; AFCRL-PSRP-552) Avail: NTIS CSCL 09/1

An integral equation has been developed for the reflection coefficient from an arbitrary perturbation in the complex dielectric constant of a dielectric plug inside a rectangular waveguide.

Using the variational approximation the integral equation for the reflection coefficient is solved when the perturbation is small.
Author (GRA)

N74-10220# Mississippi Univ., University. Engineering Experiment Station.
LOG-PERIODIC DIPOLE ARRAY - A NUMERICAL ANALYSIS
Hyong K. Choe and Charles E. Smith Jun. 1973 81 p refs (Grant NSF GU-3833)
(PB-221995/4; Bull-17) Avail: NTIS HC $6.25 CSCL 09E

The report presents a numerical solution of log-periodic dipole arrays using a straightforward method of moments analysis. A set of coupled Hallen-type integral equations are reduced to a system of linear algebraic equations through the use of a three-term expansion set in conjuction with point matching. A digital computer program is developed for the study, and the results of the numerical computation are compared with existing theoretical and experimental data. Author (GRA)

N74-10221# Michigan Univ., Ann Arbor. Electron Physics Lab.
CHARACTERISTICS OF IMPATT DIODE REFLECTION AMPLIFIERS Ph.D. Thesis
R. W. Laton Mar. 1973 192 p refs
(Contract F30602-71-C-0099; ORA Proj. 037250)
(AD-760136; RADC-TR-73-61; UMICH-037250-128) Avail: NTIS CSCL 09/5

The purpose of this study is to investigate the gain, stability, power saturation and bandwidth properties of microwave reflection amplifiers which employ IMPATT diodes as the active element, together with the dependence of all these properties upon device material, doping profile and operating conditions. The investigation provides a method for the design of stable negative-resistance amplifiers and an understanding of the limitations imposed on such amplifiers when the active device is an IMPATT diode. Data are presented which indicate that power addition, gain saturation and bandwidth are all optimized by devices with narrow avalanche widths, high current densities and low temperatures. (Modified author abstract) GRA

N74-10222# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
BIPOLAR VOLTAGE PULSE DAMAGE EFFECTS ON TRANSISTORS
Kenneth W. Plunkett 8 Aug. 1973 42 p refs
(AD-766685; RG-73-17) Avail: NTIS CSCL 09/1

The statistical significance of bipolar or unipolar voltage pulses on transistor junction damage was investigated experimentally. The controlled independent variables of the experiment were pulsed voltage bias sequence, transistor junction tested, and current-limiting series resistance, each with three levels. The dependent variable was the common emitter dc gain measured at 15 volts, 0.5 milliampere. The transistor junction damage induced by the bipolar voltage pulses used in the experiment was not significantly different from the single reverse bias pulse-induced damage. Transistion times between polarities of the bipolar pulses of 1 microsecond prevent general extension of the experimental conclusions. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N74-10223* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TECHNIQUE FOR EXTENDING THE FREQUENCY RANGE OF DIGITAL DIVIDERS Patent
Walt C. Long and Joan H. Middleton, inventors (to NASA) Issued 9 Oct. 1973 6 p Filed 30 Mar. 1972 Supersedes N72-27255 (10 - 18, p 2404)
(NASA-Case-LAR-10730-1; US-Patent-3,764,790; US-Patent-Appl-SN-239573; US-Patent-Class-235-92CA; US-Patent-Class-235-92DM; US-Patent-Class-307-225R; US-Patent-Class-328-48; US-Patent-Class-235-150.3) Avail: US Patent Office CSCL 09C

A technique for extending the frequency range of a presettable digital divider is described. The conventional digital divider consists of several counter stages with the count of each stage compared to a preselected number. When the counts for all stages are equal to the preselected numbers, an output pulse is generated and all stages are reset. For high input frequencies, the least significant stage of the divider has to be reset in a very short time. This limits the frequency that can be handled by the conventional digital divider. This invention provides a technique in which the second least significant and higher stages are reset and the least significant stage is permitted to free-run. Hence, the time in which the reset operation can be performed is increased thereby extending the frequency range of the divider.
Official Gazette of the U.S. Patent Office

N74-10224 Santa Clara Univ., Calif.
CONTROL SYSTEM DESIGN USING EXTENSIONS OF THE PARAMETER PLANE CONCEPT Ph.D. Thesis
John Barrett Moore 1969 115 p
Avail: Univ. Microfilms Order No. 73-9241

Extensions of the parameter plane concept are presented which have application in the design of linear, nonlinear, sampled data and time delay systems. In linear system design, a systematic approach is presented for the selection of the structure and parameters of a multi-parameter system. With modifications some of the methods may be applied in the design of sampled data and time delay systems. Two particular results are presented because of their contribution to the parameter plane theory. The first is a straight-forward, convergent, rapid method for the solution of polynomial equations. The second is the design of an inertially stabilized attitude control system for a space vehicle using the various concepts developed for linear system design.
Dissert. Abstr.

N74-10225*# National Aeronautics and Space Administration, Washington, D.C.
COMPUTER PROGRAMS: ELECTRONIC CIRCUIT DESIGN CRITERIA: A COMPILATION
[1973] 13 p refs
(NASA-SP-5963(01)) Avail: NTIS HC $1.00 CSCL 09C

A Technology Utilization Program for the dissemination of information on technological developments which have potential utility outside the aerospace community is presented. The 21 items reported herein describe programs that are applicable to electronic circuit design procedures. Author

N74-10226*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN GUIDELINES FOR USE OF ADHESIVES IN HYBRID MICROCIRCUITS
Salvadore V. Caruso, K. L. Perkins (Rockwell Intern.), and J. J. Licari (Rockwell Intern.) Jul. 1973 70 p refs
(NASA-TM-X-64789) Avail: NTIS HC $5.50 CSCL 09C

Although it is generally accepted that the use of adhesives in the assembly of hybrid microcircuits offers advantages over other bonding methods, there currently does not exist a set of guidelines for the selection of adhesives which will insure that hybrid microcircuits assembled with them will meet the long use-life, high-reliability requirements of electronic equipment for space applications. This study was directed to the identification of the properties of electrically insulative adhesives that potentially could cause problems in such an application, and to the development of evaluation tests to quantify these properties and thus form the basis for establishing suitable guidelines and, ultimately, specifications. Bond strength, outgassing after cure, and corrosivity were selected for detailed attention since they are considered to be especially critical. Introductory discussion includes enumeration and brief comments on the properties of adhesives considered to be important for the proposed application, a general review of polymeric types of adhesives, and identification of the major types of adhesives commercially available and specifically designed for microelectronic use. The specific tests developed to evaluate bond strength, outgassing after cure, and corrosivity are discussed in detail, and comparative results obtained for selected adhesives representative of the major types are given. Author

N74-10227# Centre National de la Recherche Scientifique, Toulouse (France). Lab. d'Automatique et d'Analyse des Systemes.
DESIGN AND MAINTENANCE OF LOGICAL SYSTEMS Annual Report, Jul. 1972 - Jul. 1973 [CONCEPTION ET MAINTENANCE DES AUTOMATISMES LOGIQUES]
P. Azema, R. David (Lab. d'Autom., Grenoble, France), and C. Durante (Lab. d'Autom., Montpellier, France) Jul. 1973 27 p refs In FRENCH
(LAAS-1048; RCP-265) Avail: NTIS HC $3.50

An activity report for design and maintenance of logical systems at the French Laboratoire d'Automatique et d'Analyse des Systemes (LAAS) is presented. The first part includes: complex sequential systems (asynchronous automata with parallel evolutions) using graph-tree methods for asynchronous coordination; synthesis of industrial automata using CUSA (universal calls for asynchronous sequence); and modelling of sequential systems using a nearly defined phase flow chart method for which a computer program is being written. Part 2 includes: results on codes K among N applied to sequential machines in the case of failure (fail safe); codes one among N for self testing circuits; and on line logic circuit testing feasibility studies. Part 3 covers: logic macronetwork (1000 gates) theoretical studies using the Boolean difference method; structure testability for proper maintenance scheme definition; building of a pseudorandom, input sequence, testing machine; machine oriented languages for macronetwork description; external and internal modelling for MSI and LSI components; and programs for efficiency verification of test programs. ESRO

N74-10228# Purdue Research Foundation, Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM MICROCIRCUITS Semiannual Technical Report, 1 Jan. - 30 Jun. 1973
R. W. Vest 1 Aug. 1973 55 p refs
(Grant DAHC15-70-G-0007; ARPA Order 1642)
(AD-765833) Avail: NTIS CSCL 09/5

The solubility of RuO2 in 63% PbO-25% B2O3-12% SiO2 glass has been determined as a function of temperature, both for the equilibrium case and for times typically associated with thick film resistor firing. Studies with the hot stage metallograph have demonstrated the feasibility of obtaining quantitative sintering data with this experimental tool, and have shown the release of gas bubbles from resistors for unexpectedly long periods of time at normal firing temperatures. Possible sources of the escaping gas and the implication as regards the sintering model are discussed. Resistor firing studies have demonstrated that the microstructure formation can be successfully slowed by lower temperature operation while still developing the identical ultimate structure. Studies of resistance during the microstructure development process have led to the conclusion that two different charge transport mechanisms may occur during the firing sequence, and that the relative contributions of these two mechanisms depend upon the particle size and particle size distribution of the conductive phase, as well as the degree of dispersion of the formulation. (Modified author abstract) GRA

N74-10229# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
TRANSPORTABILITY
7 Feb. 1973 74 p
(AD-765456; TOP-1-2-500) Avail: NTIS CSCL 09/3

The report describes a method for evaluation of military equipment transportability characteristics; discusses preliminary activities, facilities, and equipment required; and provides procedures for lifting and tiedown attachments; rail, highway, and marine transportability; terminals handling and movement; air portability, fixed and rotary wing, internal and external carried, to include airdropped materiel, shock, vibration, safety, human factors, and maintenance evaluation. Appendixes provide railway landing procedures, highway vehicle and load limits, marine transport environmental factors and characteristics, aircraft capacities, shock and vibration environments during transport by rail, sea, and air. The method is applicable to equipment whether towed, self-propelled, or moved by carrier over highway, cross-country, railway, waterway, or air. Author (GRA)

N74-10230# General Electric Co., Philadelphia, Pa. Space Div.
RADIATION HARDENED DETECTOR ELECTRONICS Final Report, 9 May - 31 Dec. 1972
William E. Austin, David M. Long, David H. Swant, Charles J. Repper, and David L. Enlow 23 Apr. 1973 143 p refs
(Contract F19628-72-C-0335; AF Proj. 6096)
(AD-766442; AFCRL-TR-73-0288) Avail: NTIS CSCL 09/1

An electronic method of reducing the effective noise induced in integrating optical detectors was developed and tested using simulated nuclear pulses. The technique uses compensation, in which a mirror image of the nuclear pulse is generated from a differentiated portion of the signal and added back to the main signal to achieve cancellation. This reduced the nuclear radiation noise by at least 30 db. A study was made to scope out the transient radiation response and the electrical operating characteristics of JFETs and MISFETs at temperatures ranging from room temperature down to 4K. Experimental measurements were performed on silicon JFET and MISFET devices, including dc electrical parameters and Flash X-ray radiation response. Analytical effort provides a compilation of silicon properties at low temperature, and scopes out the first-order temperature dependence of JFETs and MISFETs. The results show that reasonable agreement is achieved between predicted and observed behavior in most areas, though there are many problems which must be resolved to achieve adequate modeling and understanding of relevant phenomena. (Modified author abstract) GRA

N74-10231# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ACOUSTIC SURFACE WAVE DIFFRACTION AND BEAM STEERING Physical Sciences Research Papers
Thomas L. Szabo and Andrew J. Slobodnik, Jr. 3 May 1973 96 p refs
(AF Proj. 5635)
(AD-766427; AFCRL-TR-73-0302; AFCRL-PSRP-548) Avail: NTIS CSCL 09/5

The report contains a detailed description of diffraction in acoustic surface wave devices. This source of loss is highly important in the design and realization of bandpass filters, long time delay lines and other devices for electronic sensors and communications systems. A complete review of acoustic surface wave diffraction on anisotropic substrates is presented. Full experimental verification of theory is provided. Complete computer program listings and descriptions are provided. The limits of applicability of the parabolic velocity surface theory are quantitatively delineated. Universal diffraction loss design curves are given for all parabolic materials. A limitation in the use of the exact angular spectrum of waves theory occurs for materials having a power flow angle slope approximately -1 unless the velocity surfaces are very accurately known. Both YZ LiNbO3 and 16-1/2 degree double rotated LiNbO3 fall in this category. Approximate diffraction loss design curves are given for YZ LiNbO3. A complete tabular summary of all important material properties affecting acoustic surface wave device design is included. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N74-10232*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACE SIMULATION, 7TH
Washington 1973 935 p refs Conf. held at Los Angeles, 12-14 Nov. 1973; sponsored by AIAA, Am. Soc. for Testing and Mater., Inst. of Environ. Sci., and NASA
(NASA-SP-336) Avail: NTIS MF $1.45; SOD HC $6.85 CSCL 14B

Space simulation facilities and techniques are outlined that encompass thermal scale modeling, computerized simulations,

reentry materials, spacecraft contamination, solar simulation, vacuum tests, and heat transfer studies. For individual titles, see N74-10233 through N74-10296.

N74-10233* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE SIMULATION TESTING FOR THE SKYLAB WASTE TANK
C. A. Skinner, R. Gershman, and L. C. Kvinge *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 1-6 refs (For availability see N74-10232 01-11)
CSCL 14B

Large scale space simulation testing was accomplished for the Skylab waste tank concept. Investigations included vapor generation rates for liquids dumped into a low pressure tank, sublimation of ice at low pressure, and pressure drop and blockage phenomena for fine mesh filter screens. In summary, the test program demonstrated that liquid dump rates and vent system flow rates can be predicted accurately enough to provide for maintaining the waste tank pressure below the triple point pressure of water. The effectiveness of the fine mesh screens as filters in a low pressure environment was demonstrated. Author

N74-10234* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A THERMAL VACUUM TEST OF SKYLAB ORBITAL WORKSHOP REFRIGERATION SUBSYSTEM c31
F. W. Sun and R. A. Deak *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 7-18 (For availability see N74-10232 01-11)
CSCL 14B

The facilities, test support equipment, and test setup of a thermal qualification test performed on a fully operational refrigeration subsystem are described. This subsystem consists of a radiator, radiator thermal control unit, pump assembly, wardroom freezer, food freezer, urine freezer, urine chiller (simulated), water chiller, and electrical cold plate. These components and the connecting plumbing comprise one complete coolant loop of the refrigeration system thermally and is functionally equivalent to the flight system. Coolant is circulated through freezers and chillers accepting heat for rejection to space by radiation. Design features and thermal operating characteristics of the test specimen are discussed. Author

N74-10235* General Electric Co., Philadelphia, Pa. Missile and Space Div.
GENERAL ELECTRIC COMPANY UNDERWATER ENVIRONMENTAL LABORATORY'S ZERO G TECHNIQUES APPLIED TO THE ENVIRONMENT
Ruth H. Fry *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 19-30 (For availability see N74-10232 01-11)
CSCL 14B

The conversion is considered of zero G simulation techniques applicable to water environmental pollution areas such as oil spill clean-up techniques, thermal pollution, solid waste materials, industrial wastes, storm water discharge and radioactive or nuclear waste evaluation, also discussed are aircraft emergency ejection studies, automotive water impact and submersion studies, buoy/small submersible development, ocean wave/glitter pattern research and similar areas of water related research and development. Author

N74-10236* Martin Marietta Corp., Denver, Colo.
MARS SURFACE THERMAL ENVIRONMENT FOR VIKING LANDER DESIGN AND TEST
T. F. Morey and T. R. Tracey *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 31-40 refs (For availability see N74-10232 01-11)
CSCL 14B

Mars surface thermal environments have been developed for design and testing of the Viking lander, based on mission requirements and available Mars thermal data. Author

N74-10237* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL TESTING OF THE VIKING LANDER IN SIMULATED MARTIAN ENVIRONMENTS
T. Buna (Martin Marietta Aerospace, Denver, Colo.), T. R. Tracey (Martin Marietta Aerospace, Denver, Colo.), and T. W. E. Hankinson *In its* Space Simulation, 7th 1973 p 41-63 refs (For availability see N74-10232 01-11)
CSCL 14B

Techniques for the simulation of the Martian thermal environment are verified by full scale test data. Author

N74-10238* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THE RADIOMETRIC CALIBRATION AND PERFORMANCE EVALUATION OF THE ASET FACILITY
J. D. Shoore, A. B. Dauger, R. P. Day, and R. H. Meier *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 65-86 refs (For availability see N74-10232 01-11)
CSCL 14B

The advanced sensor evaluation and test facility, which simulates physical and optical exoatmospheric environmental conditions, provides the capability for radiometric calibration of infrared sensors and astronomical telescopes. The techniques and procedures developed and used to calibrate the facility are discussed. Author

N74-10239* Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
INCREASE OF THE ABSORPTANCE OF A SHROUD FOR A THERMAL TEST FACILITY AND METHODS OF DETERMINATION
H. Nuss and J. Reimann *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 87-98 refs (For availability see N74-10232 01-11)
CSCL 14B

To reduce the large amount of reflected heat radiation by the shroud of the test facility measured during the thermal balance tests on the thermal model of the Helios solar probe at high intensity (16 solar constants), the test chamber was modified by installation of a shroud with a grooved surface. Described is the shroud surface (V-grooves), and the methods used for measuring and calculating the absorptance of the grooved surface. Author

N74-10240* Lockheed Missiles and Space Co., Sunnyvale, Calif.
TESTING FOR THERMAL FATIGUE FAILURES IN SOLAR ARRAYS c03
G. J. Antonides *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 99-101 (For availability see N74-10232 01-11)
CSCL 10A

A temperature cycling test facility has been designed and constructed for the study of thermal stress and fatigue in solar arrays. Two bell jar type thermal vacuum chambers and their associated equipment and instrumentation provide close simulation of the space environment, automatic temperature cycling and data acquisition, and economical operation. Author

N74-10241* Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
A TEST FACILITY FOR 6000 HOUR LIFE TEST OF A 30 cm MERCURY ION THRUSTER
J. J. Caldwell *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 103-104 (For availability see N74-10232 01-11)
CSCL 14B

A life test facility for a mercury ion thruster is described. The thruster is mounted at the top of a space chamber and projects the ion beam downward into a liquid nitrogen cooled collector. Beam density distribution measurements are provided by two probes. Propellant and neutralizer mercury flow metering is accomplished by a weighting system, and thruster operating parameters are measured by an automatic data collecting system. G.G.

N74-10242* National Aeronautics and Space Administration. Plum Brook Reactor Facility, Sandusky, Ohio.
COMPUTER SIMULATION OF TEMPERATURES ON THE CENTAUR STANDARD SHROUD DURING HEATED JETTISON TESTS

Joseph A. Hemminger *In its* Space Simulation, 7th 1973 p 105-118 (For availability see N74-10232 01-11)
CSCL 14B

A heating fixture was built to provide a simulation of the heating and environment encountered by the Centaur standard shroud during its ascent through the earth's atmosphere. A computer program was developed to determine the overall temperature profile of a free-skin model of the Centaur standard shroud during the heating portion of the heated jettison tests. The analytic model was verified by adapting the computer program to the configuration of the hardware used in a series of intermediate scale tests performed on a 2.4 meters by 2.4 meters section of the Centaur standard shroud corrugated structure. A comparison of some predicted versus experimental results from these tests is presented. Author

N74-10243* Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
INFRARED SIMULATION AND THERMO-VACUUM FACILITY - ISA/TVA
H. J. Kurscheid *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 119-125 (For availability see N74-10232 01-11)
CSCL 14B

A test facility was designed in which the shroud temperature can be continuously variated between 100 K and 363 K by using gaseous nitrogen. Author

N74-10244* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARATIVE EVALUATION OF PREDICTED AND MEASURED PERFORMANCE OF A 68m3 TRUNCATED REVERBERANT NOISE CHAMBER
H. D. Cyphers, A. N. Munson, and F. J. On *In its* Space Simulation, 7th 1973 p 127-153 refs (For availability see N74-10232 01-11)
CSCL 14B

The performance of a medium size, truncated reverberation chamber is evaluated in detail. Chamber performance parameters are predicted, using classical acoustic theory, and compared with results from actual chamber measurements. Discrepancies are discussed in relation to several available empirical corrections developed by other researchers. Of more practical interest is the confirmation of a recent theory stating that the present rule of thumb for the ratio of specimen volume to test chamber volume, approximately ten percent, is overly conservative and can be increased by a factor of at least two and possibly three. Author

N74-10245* Bendix Corp., Denver, Colo.
DYNAMICS OF THE SKYLAB WASTE TANK SYSTEM **c31**
G. Rupprecht *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 155-174 refs (For availability see N74-10232 01-11)
CSCL 22B

The dynamics of the Skylab waste tank venting system are discussed in terms of convenient subsystems. Some representative test results are reported and the experimental observations during a waste tank simulation test are connected with the mathematical model. During experimentation with CO2 purges it was found that the sublimation rate of ice can be considerably changed by the presence of other gases. Author

N74-10246* Louisiana State Univ., Baton Rouge.
THERMAL SCALE MODELING OF A SPACECRAFT RADIATOR WITH COUPLED FORCED CONVECTION-CONDUCTION-RADIATION HEAT TRANSFER
David P. Colvin (Becton, Dickinson Res. Center) and Dupree Maples *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p175-190 refs (For availability see N74-10232 01-11)
CSCL 14B

A thermal model of a spacecraft radiator has been designed and tested. The unique feature of this model is that all three modes of heat transfer--forced convection, conduction, and radiation--are utilized simultaneously under steady-state conditions. A fluid is forced under pressure using similar flow conditions through both prototype and model which are suspended within a cryogenic vacuum chamber. Heat is transferred from the fluid to the tube's inside wall, which then conducts the energy to its outer surface where it is radiated to the surrounding shell that is maintained at a cryogenic temperature with liquid nitrogen. A high vacuum chamber at the facility is used to house the experiment. The effects of physical size and fluid flow parameters on the modeling criteria for both low and high thermal conductivity materials are presented. Author

N74-10247* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SIMULATION OF MARTIAN AND EOLIAN PHENOMENA IN THE ATMOSPHERIC WIND TUNNEL
J. D. Iversen (Iowa State Univ.), R. C. Greeley (Santa Clara Univ.), J. B. Pollack, and B. R. White (Iowa State Univ.) *In its* Space Simulation, 7th 1973 p 191-213 refs (For availability see N74-10232 01-11)
CSCL 14B

Comparisons are made between the Mariner 9 photographs of wake streaks associated with craters on Mars, and experiments conducted in an atmospheric boundary layer wind tunnel. The appropriate modeling parameters are developed and discussed. The results of threshold speed experiments for a variety of particle densities and diameters are presented and used to predict threshold speeds on Mars. Author

N74-10248* City Univ., London (England). Dept. of Aeronautics.
SIMULATION OF SPACECRAFT INTERACTION WITH A PARALLEL-STREAMING PLASMA
Anthony R. Martin and Richard N. Cox *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 215-229 refs (For availability see N74-10232 01-11)
CSCL 14B

An experimental study of the wakes produced by spacecraft moving in the ionosphere is reported. The work was done in an argon ion beam simulation facility which incorporated features enabling the production of a low background density of slow ions and an essentially parallel ion beam. The occurance of these features, and their effect on the simulation validity in previous work is briefly reviewed. Stable variation of the divergence of the beam was possible and results are given of wake studies for a range of body size and potential in both parallel and divergent beams. Author

N74-10249* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SIMULATION AS A COMPUTER DESIGN AID **c08**
J. E. Weatherbee (Computer Sciences Corp., Huntsville Ala.), D. S. Taylor (Computer Sciences Corp., Huntsville, Ala.), and B. C. Hodges *In its* Space Simulation, 7th 1973 p 231-249 refs (For availability see N74-10232 01-11)
CSCL 09B

The use of simulation in evaluating hardware and software design concepts for the Automatically Reconfigurable Modular Multiprocessing System (ARMMS) is discussed. Two simulation models are described and results obtained from simulations conducted with these models were presented. Author

N74-10250* Aerojet Electrosystems Co., Azusa, Calif.
DEVELOPMENT OF A STOCHASTIC SIMULATION MODEL FOR PERFORMANCE EVALUATION
E. Gordon and P. G. Freese *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 251-263 refs (For availability see N74-10232 01-11)
CSCL 14B

Simulation played a vital role in the evaluation of the performance of an extremely accurate attitude determination system before it was built and flight tested. This attitude determination system uses a high sensitivity star sensor. The sensing element is an electron multiplier phototube which responds to incident radiation within a few nanoseconds. This system was simulated using a set of programs in which the effects derived from the shorter time constant simulations are explicitly represented in the next model up. A representation of the stochastic effects in a manner usable for the models is reported. Author

N74-10251* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CONTAMINATION CONTROL IN SPACE SIMULATION CHAMBERS
B. C. Moore, R. G. Camarillo, and L. C. Kvinge *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 265-279 refs (For availability see N74-10232 01-11)
CSCL 14B

Protection of sensitive vehicle surfaces during space simulation tests requires that the chamber be clean. Various methods of cleaning are considered. Experience with vacuum outgassing a 39 ft diameter space chamber is reviewed. It is shown that acceptably low contamination rates may be achieved with the present state-of-the art. Possible future developments are discussed, including the use of fluorocarbon pump oil, and cleaning with atomic oxygen. Author

N74-10252* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE SIMULATION ULTIMATE PRESSURE LOWERED TWO DECADES BY REMOVAL OF DIFFUSION PUMP OIL CONTAMINANTS DURING OPERATION
Alvin E. Buggele *In its* Space Simulation, 7th 1913 p 281-301 refs (For availability see N74-10232 01-11)
CSCL 14B

The complex problem why large space simulation chambers do not realize the true ultimate vacuum was investigated. Some contaminating factors affecting diffusion pump performance have been identified and some advances in vacuum/distillation/fractionation technology have been achieved which resulted in a two decade or more lower ultimate pressure. Data are presented to show the overall or individual contaminating effect of commonly used phthalate ester plasticizers of 390 to 530 molecular weight (M.W.) on diffusion pump performance. Methods for removing contamination from diffusion pump silicon oil during operation and reclaiming contaminated oil by high vacuum molecular distillation are described. Author

N74-10253* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A METHOD FOR PREDICTING BLAST WAVE OVERPRESSURE PRODUCED BY RUPTURE OF A GAS STORAGE VESSEL **c12**
P. W. Garrison *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 315-439 refs (For availability see N74-10232 01-11)
CSCL 20D

A method, based on a hydrodynamic solution to the spherical shock problem, is developed to predict blast wave overpressure. Generalized curves are presented that permit the application of this technique to a wide range of pressure vessel sizes and pressures. Safety analyses of high pressure system failures are normally based on scaled explosive data (TNT scaling). An evaluation of available experimental data indicates that the hydrodynamic model provides a better approximation of blast overpressures generated when a pressure vessel ruptures. Author

N74-10254* McDonnell Aircraft Co., St. Louis, Mo.
LEAK TESTING OF HIGH PRESSURE OXYGEN AND NITROGEN TANK SYSTEMS FOR THE SKYLAB AIRLOCK
R. A. Dutton (McDonnell-Douglas Astronautics Co., St. Louis, Mo.), G. L. Adlon, R. K. Weinberger, and R. G. Morris, Jr. *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1972 p 331-343 ref (For availability see N74-10232 01-11) (Contract NAS9-6555)
CSCL 14B

An existing propulsion test facility was modified for use as a leak test facility for acceptance testing of the 3000 psig oxygen and nitrogen gas storage tank systems used on the Skylab airlock U-1 and U-2 vehicles. Leak rates in the range of 0.01 to 0.00001 standard cc/sec of helium were measured remotely from an explosion containment test cell. Selection of the test site was based on consideration of techniques, equipment, potential test hazards, leak measurement methods, and the availability of existing applicable equipment from prior test programs. Facility design, operating experience, and test results are discussed. Author

N74-10255* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOELECTRICALLY-COOLED QUARTZ CRYSTAL MICROBALANCE **c14**
D. McKeown (Faraday, Labs., Inc.), W. E. Corbin, Jr. (Faraday, Labs., Inc.), and R. J. Naumann *In its* Space Simulation, 7th 1973 p 345-356 refs (For availability see N74-10232 01-11) (Contracts NAS8-27879; NAS5-11163)
CSCL 14B

A quartz crystal microbalance is of limited value in monitoring surface contamination on satellites or in space simulation chambers because it operates several degrees above ambient temperatures. The amount of contamination absorbed on a surface is highly temperature dependent and the higher temperature of the microbalance will significantly reduce the amount of contamination it adsorbs. To overcome this problem a thermoelectrically cooled quartz crystal microbalance has been developed to monitor surface contamination as a function of temperature. Author

N74-10256* Celesco Industries, Costa Mesa, Calif.
DEVELOPMENT OF A MINIATURE CRYOGENIC QCM FOR LOW TEMPERATURE CONTAMINATION MEASUREMENT **c14**
D. A. Wallace *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 357-366 refs (For availability see N74-10232 01-11)
CSCL 14B

A need exists in contamination monitoring for a mass monitor which is small in size, has monolayer coverage detectability, is capable of operation to liquid helium temperature and dissipates a minimum amount of power. The development of a miniature QCM is shown that meets the above needs. The mass sensitivity and the mass detectability are considered analytically and the crystal temperature coefficient and the mass range are shown experimentally to be comparable to larger QCM's operated at ambient (25 C) temperature. Author

N74-10257* Celesco Industries, Costa Mesa, Calif.
TRANSIENT FREQUENCY EFFECTS IN PIEZOELECTRIC QUARTZ CRYSTALS CAUSED BY INCIDENT THERMAL RADIATION **c26**
D. A. Wallace *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 367-378 refs (For availability see N74-10232 01-11)
CSCL 20B

An analytical and experimental program examined step function and cyclic thermal irradiance of piezoelectric crystals. Metal crystal electrodes with different alpha/epsilon ratios as well as dielectric over-coated electrodes were tested. Author

N74-10258* Aerospace Corp., El Segundo, Calif.
PHOTOGRAPHIC MEASUREMENT OF PARTICULATE SURFACE CONTAMINATION **c14**
O. Hamberg *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 379-399 refs (For availability see N74-10232 01-11)
CSCL 14E

The particulate surface cleanliness of spacecraft is important to the proper functioning of certain spacecraft devices. The limitations of some surface contamination measurements currently used are reviewed and it is shown how an approach based on the use of macrophotography has advantages over the usual methods for field measurement of assembled spacecraft. These advantages are that no contact with sensitive surfaces is required, the measurement is direct, and a permanent record is provided. The results of an experiment which compares particle visibility and sizing using 4X macrophotography with 37X photomicrography are provided. These results indicate that macrophotography with non-optimized equipment provides reasonable accuracy down to 16 microns. Author

N74-10259* General Electric Co., Philadelphia, Pa.
MEASUREMENT ON CONDENSATE FILM CONTAMINATION ON CRITICAL SURFACES BY CHARGED PARTICLE EXCITED X-RAY FLUORESCENCE **c14**
W. P. Saylor *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 401-419 refs (For availability see

N74-10232 01-11)
CSCL 14B

The determination of trace quantities of a hydrocarbon film contaminant on critical surfaces by a charged particle excited X-ray fluorescence method is reported. The method was successfully employed for constructing an instrument to be used to measure condensate contaminants deposited on optical and thermal control surfaces of the Nimbus 5 spacecraft after environmental testing. Data are presented showing the measured thickness of hydrocarbon film condensed during the environmental testing period. Measurements were also used to establish the effective removal of these contaminant films. Author

N74-10260* Texas A&M Univ., College Station.
EVALUATION OF RADIOISOTOPE TRACER AND ACTIVATION ANALYSIS TECHNIQUES FOR CONTAMINATION MONITORING IN SPACE ENVIRONMENT SIMULATION CHAMBERS
J. B. Smathers, W. E. Kuykendall, Jr., R. E. Wright, Jr., and J. R. Marshall, Jr. *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 421-435 refs (For availability see N74-10232 01-11)
(Contract NAS9-12586)
CSCL 14B

The use of radioisotope tracer and activation analysis techniques in the determination of space simulation chamber contaminant levels was evaluated in a theoretical study. Each procedure was evaluated based on its sensitivity, ability to identify specific contaminants, speed of analysis, suitability for real-time operation, radiological safety and cost of implementation. Of the many techniques considered, only alpha particle range variation with mass density of chamber atmosphere, indicated a sensitivity, 1.9 x 10-10 g/sq cm competitive with methods presently in use. Author

N74-10261* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OUTGASSING TESTS IN SUPPORT OF A PROPOSED ASTM SPECIFICATION c18
John J. Park, Richard S. Marriott, William A. Campbell, Jr., and Charles L. Staugaitis *In its* Space Simulation, 7th 1973 p 437-448 ref (For availability see N74-10232 01-11)
CSCL 11D

The data gathered from three different laboratories by the technique of determining the weight loss in vacuum at 125 C and of collecting the volatile condensable materials at 25 C in vacuum are presented. Two sets of eight commercial samples were tested as was one commercial material prepared to help resolve some variations in results. Author

N74-10262* Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A SHROUDED FLOW ARC AIR HEATER FOR SIMULATION OF A 250 MEGAWATT PLASMA JET HEATER
J. C. Beacher and W. A. Kachel *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 449-463 refs (For availability see N74-10232 01-11)
CSCL 14B

A shrouded flow arc air heater producing the pressure field and centerline temperature of a 250 MW plasma jet heater has been developed for reentry missile nose tip testing. Author

N74-10263* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THE ABLATION PERFORMANCE OF FOAMS IN A LOW HEAT FLUX c18
D. H. Smith and D. R. Hender *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 465-476 refs (For availability see N74-10232 01-11)
CSCL 11G

Tests of ablation performance of low-density, polyurethane-based foams have been conducted in a low heat flux plasma arc environment. It is shown that fire retardant chemicals included in the foam have a significant effect in reducing surface recession, and that these materials are attractive candidates for ablative cryogenic insulation systems. Author

N74-10264* LTV Aerospace Corp., Dallas, Tex.
SPACE SHUTTLE ENTRY ENVIRONMENT TESTING TECHNIQUES c18
E. L. Mulcahy and R. R. Rogers *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 477-487 (For availability see N74-10232 01-11)
CSCL 11D

Testing techniques have been developed for simulating the high temperature portion of the entry environment to test large space shuttle leading edge structural segments. The test techniques involve the use of arrays of graphite heating elements which radiate heat to the test articles. Author

N74-10265* Battelle Columbus Labs., Ohio.
RESPONSE OF CANDIDATE METALLIC SPACE SHUTTLE MATERIALS TO SIMULATE REENTRY ENVIRONMENTS c17
I. M. Grinberg, E. S. Bartlett, and R. G. Luce *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 489-505 refs (For availability see N74-10232 01-11)
CSCL 11F

Coated columbium alloys were evaluated in an experimental program to determine their degradation and reuse capability for the thermal protection system of the space shuttle. Intentionally defected specimens were thermally cycled in either an arc heated wind tunnel or static furnace environment. The relative effect of the environmental exposures on defect growth, mechanical properties, and surface emittance degradation was determined. Techniques used to characterize the arc heated wind tunnel environment and to determine the thermal response of the specimens during the exposures are described. Author

N74-10266* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TESTING OF SPACE SHUTTLE THERMAL PROTECTION SYSTEM PANELS UNDER SIMULATED REENTRY THERMO-ACOUSTIC CONDITIONS c31
Carl E. Rucker and Robert E. Grandle *In its* Space Simulation, 7th 1973 p 507-521 refs (For availability see N74-10232 01-11)
CSCL 22B

The advantages of maintaining a real time computerized thermoacoustic testing system are demonstrated by results from space shuttle thermal protection system tests of Rene 41 and composite material panels. Author

N74-10267* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SIMULATION OF THREE-DIMENSIONAL COOLANT FLOW WITHIN TRANSPIRATION NOSETIPS c12
J. R. Schuster and G. E. Seay *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p523-542 refs (For availability see N74-10232 01-11)
CSCL 20D

Steady state equations are presented to describe coolant mass and energy transfer within transpiration nose tips. The energy model, which assumes thermal equilibrium between the collant and matrix, is justified on the basis of pore size. An iterative computational technique is given which can be applied to the finite difference equivalents of the steady state equations, causing a relaxation in the pressure and enthalpy fields to satisfy the boundary conditions. To maintain stability, the calculations must be damped. The final results show isothermal approximations to be substantially in error for high- and low-pressure reentry conditions. Author

N74-10268* Martin Marietta Corp., Denver, Colo.
INVESTIGATION OF CRITICAL DEFECTS IN ABLATIVE HEAT SHIELD SYSTEMS c33
C. C. Miller and W. D. Rummel *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 543-554 refs (For availability see N74-10232 01-11)
CSCL 20M

An experimental program was conducted to determine the effects of fabrication induced defects on the performance of ablative heat shield materials. Critical defects were identified and methods of their detection during inspection were established. Steps to streamline the fabrication and inspection processes were

then postulated in order to lower the mass production costs of these material composites in the event that they were to be used on a space shuttle orbiter. Author

N74-10269* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
PROPERTIES OF A CLOSED PORE INSULATION THERMAL PROTECTION SYSTEM c33
A. Tobin, C. Feldman, M. Russak, and J. Reichman *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 555-565 refs (For availability see N74-10232 01-11)
(Contracts NAS1-10713; NAS9-12781)
CSCL 20M

The need to develop a 100 mission reusable external thermal protection system for the space shuttle orbiter has led to the development of a unique closed-cell glass ceramic foam insulation derived from sintering fly ash cenospheres in the presence of a high emittance binder. The outstanding characteristics of this material are: (1) Rigidity; (2) water repellant structure; (3) high emittance; (4) machinability; (5) outstanding mechanical properties; and (6) good thermal shock resistance. Detailed design integration studies have led to the construction and testing of scaled-up heat shield panels which have survived reentry cycling in areas 1 and 2 of the shuttle. Author

N74-10270* Martin Marietta Corp., Denver, Colo.
ABLATIVE HEAT SHIELD DESIGN FOR SPACE SHUTTLE c33
R. W. Seiferth *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 567-581 (For availability see N74-10232 01-11)
(Contract NAS1-11592)
CSCL 20M

Ablator heat shield configuration optimization studies were conducted for the orbiter. Ablator and RSI trajectories for design studies were shaped to take advantage of the low conductance of ceramic RSI and high temperature capability of ablators. Comparative weights were established for the RSI system and for direct bond and mechanically attached ablator systems. Ablator system costs were determined for fabrication, installation and refurbishment. Cost penalties were assigned for payload weight penalties, if any. The direct bond ablator is lowest in weight and cost. A mechanically attached ablator using a magnesium subpanel is highly competitive for both weight and cost. Author

N74-10271* Martin Marietta Corp., Denver, Colo.
A STUDY OF ABLATOR PRODUCIBILITY AND REFURBISHMENT METHODS c21
William E. King, Jr. *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1972 p 585-604 (For availability see N74-10232 01-11)
CSCL 22B

Fabrication, installation, and removal methods are studied for ablative thermal protection systems by using a lifting body space vehicle airframe as a full size demonstration test bed for prototype hardware. Author

N74-10272* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DEVELOPMENT OF TECHNIQUES FOR ADVANCED OPTICAL CONTAMINATION MEASUREMENT WITH INTERNAL REFLECTION SPECTROSCOPY c14
R. G. Richmond, J. D. Hayes (Teledyne-Brown Eng., Huntsville, Ala.), and N. E. Chatterton (Teledyne-Brown Eng., Huntsville Ala.) *In its* Space Simulation, 7th 1973 p 609-633 refs (For availability see N74-10232 01-11)
CSCL 14B

Described is a technique of monitoring volatile contaminants in a large space simulation chamber by using internal reflectance spectroscopy. The analytical phase includes: (1) parameter effects determination; (2) thin film/thick film/bulk sample optimization analysis; (3) optical properties of candidate internal reflectance element (IRE) materials; (4) IRE design considerations; and (5) potential system range and sensitivity. Three IRE's were fabricated. Experimental results of IRE infrared spectra for six potential contaminants are reported. Author

N74-10273* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE VACUUM-ULTRAVIOLET DEGRADATION OF SALT-SPRAY-CONTAMINATED THERMAL CONTROL COATINGS c33
H. M. King and J. E. Gilligan (IIT Res. Inst., Chicago, Ill.) *In its* Space Simulation, 7th 1973 p 637-644 (For availability see N74-10232 01-11)
(Contract NAS8-28765)
CSCL 11C

An experimental program in which salt-spray-exposed coatings have been irradiated is described and discussed. Author

N74-10274* Aerospace Corp., El Segundo, Calif.
THE FAR ULTRAVIOLET PHOTOLYSIS OF POLYMETHYLPHENYLSILOXANE FILMS ON QUARTZ SUBSTRATES c06
P. D. Fleischauer and L. Tolentino *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 645-650 refs (For availability see N74-10232 01-11)
CSCL 07D

Siloxane films containing phenyl and methyl substituents in different proportions were irradiated with ultraviolet light in the wavelength region 147-229 nm. This far ultraviolet irradiation produced increased equivalent solar absorptance alpha sub s of the films. The measured increases depend on the thicknesses and the compositions of the films and on the wavelength of incident radiation. Author

N74-10275* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
HIGH INTENSITY SOLAR SIMULATION TEST FOR STRUCTURE PARTS AND EXPERIMENTS FOR THE HELIOS SOLAR PROBE
P. Kleber *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 653-661 refs (For availability see N74-10232 01-11)
CSCL 14B

The entire Helios solar probe cannot be tested with the intensity of 16 solar constants corresponding to 0.25 AU mission. Therefore critical parts of the solar probe have been tested in an especially built solar simulation test facility. After a brief description of the solar simulation system, the different requirements and their technical solution are discussed. This includes the possibilities of flash illumination corresponding to the spin rate of Helios, as well as the background for the test article. Author

N74-10276* Hughes Aircraft Co., El Segundo, Calif.
DEVELOPMENT OF A HEATER POST AND SPOTLIGHT ARRAY FOR THERMAL VACUUM TESTING OF THE INTELSAT 4 COMMUNICATIONS SATELLITE
Lloyd A. Nelson and Milton B. Levine *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 663-669 (For availability see N74-10232 01-11)
CSCL 14B

A thermal simulation system developed to provide a reliable thermally acceptable simulation of orbital solar radiation for space simulation testing of a spinning spacecraft is discussed. The thermal system consists of a high intensity IR lamp array which provides radiant energy to the spinning solar panel section, as well as a spotlight array which maintains proper temperatures on the despun antenna farm. Author

N74-10277* Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
SOLAR PROBE HELIOS, MISSION REQUIREMENTS AND APPLIED SPACE SIMULATION TECHNIQUES
H. Schuetz and R. A. Karsten *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 671-678 refs (For availability see N74-10232 01-11)
CSCL 14B

The Helios mission with maximum irradiation up to 16 S.C. requires special simulation techniques. The different simulation techniques and their realization are described. Author

N74-10278* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE DESIGN AND OPERATION OF AN INFRARED SIMULATOR FOR TESTING OF THE SHUTTLE RADIATOR SYSTEM

Douglas J. Skinner (Northrop Services, Inc.) and Jack E. Breiby *In its* Space Simulation, 7th 1973 p 679-694 (For availability see N74-10232 01-11)

CSCL 14B

An infrared simulation system was designed for the space shuttle modular radiator system. Various types of simulator designs were considered for conditioning of the test article during thermal vacuum testing. The design and operation of fluid controlled panels to simulate the incident infrared flux during earth orbit are discussed. The thermal capabilities of the simulator are presented. Author

N74-10279* Entwicklungsring Nord, Bremen (West Germany).

METHOD AND RESULTS OF INFRARED TESTING OF THE HELIOS SOLAR PROBE

J. Guelpen and W. Lorenz *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 695-712 (For availability see N74-10232 01-11)

CSCL 14B

The infrared test technique developed to test the Helios solar probe at intensities equivalent to up to 16 S.C. is described. The principle of this technique and the design of a test facility derived from it are discussed. The particular application of this technique to the measurement of heat input into a solar irradiated aperture is presented. Test results are compared to solar simulation test results. Author

N74-10280* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

LARGE SOLAR BEAM TESTING AT PLANET MERCURY AND GREATER INTENSITIES IN THE JPL 25 FT SPACE SIMULATOR

John W. Harrell *In* NASA. Goddard Space Flight Center Space Simulation 1973 p 713-722 ref (For availability see N74-10232 01-11)

(Contract NAS7-100)

CSCL 14B

Minor modifications to the off axis solar simulation system in the space simulator have been made which allow testing at very high solar intensities over reasonably large test areas. Tests have been conducted on Mariner and Helios class spacecraft at intensities up to 7.4 solar constants. The optical components required for these high energy solar beams can be installed or removed quickly which enhances the versatility of the facility and permits high facility utilization. Author

N74-10281* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OUTGASSING MEASUREMENTS OF A THERMAL BLANKET AND A SPACE CHAMBER USING QUARTZ CRYSTAL MICROBALANCES

J. J. Scialdone and R. Kruger *In its* Space Simulation, 7th 1973 p 729-748 refs (For availability see N74-10232 01-11)

CSCL 14B

The outgassing characteristics of an ERTS-type thermal blanket used as an insulation shell for the attitude control system of a spacecraft were investigated. A test conducted in a vacuum chamber established the thermal blanket's outgassing rate, the nature and mechanism of the outgassing and its rate of deposition on surfaces at different temperatures. The test established a method for measuring outgassing and the temperature and the duration for such outgassing. In 60 hours, the blanket outgassed a total of about 0.1 g of material that included hydrocarbon oxides, phtalates and tetrabutoxyethylene. Author

N74-10282* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MOLECULAR DENSITY DETERMINATION OF WATER VAPOR IN A 0.0001 TO 0.01 TORR VACUUM ENVIRONMENT BY ULTRAVIOLET ABSORPTION

R. G. Richmond and J. T. Visentine *In its* Space Simulation, 7th 1973 p 749-755 refs (For availability see N74-10232 01-11)

CSCL 14B

A new sensor has been developed for water vapor molecular density measurements in a space environment simulation chamber. Its intended use is to obtain measurements in the exit planes of supersonic nozzles without disturbing the plume flow field in the chamber. A laboratory version of the sensor has been built and tested in a static pressure environment to determine its sensitivity. The results show that the sensor is extremely sensitive in detecting water vapor, and that its useful measurement range exceeds ten to the 15th power molecules/cc. Author

N74-10283* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

MATHEMATICAL MODEL OF MOLECULAR FLOW IN THE NASA-JSC THERMAL-VACUUM CHAMBER A c23

A. L. Lee (Lockheed Missiles and Space Co., Huntsville, Ala.), S. J. Robertson (Lockheed Missiles and Space Co., Huntsville, Ala.), and Horst K. F. Ehlers *In its* Space Simulation, 7th 1973 p 757-773 refs (For availability see N74-10232 01-11)

CSCL 20C

A new computer program has been developed for the math modeling of molecular flux inside a typical large thermal vacuum chamber. It can be applied in four general areas: prediction, evaluation and improvement of the chamber performance; prediction of contamination migration; location of sources of leaks and outgassing; and design of new thermal-vacuum chambers. Author

N74-10284* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A UNIQUE HIGH INTENSITY SOLAR SIMULATION SYSTEM

Leo Romanowski, Jr. and Ignatius N. Serafino *In its* Space Simulation, 7th 1973 p 775-794 refs (For availability see N74-10232 01-11)

CSCL 14B

This simulator is unique in that it is capable of producing intensities up to 16.0 solar constants (25 solar constants without spectral filters) and closely simulates the solar spectrum over a 12 inch diameter area. The simulator is described and the capabilities, calibration, operational experiences, data collection, and safety considerations associated with this simulator are discussed. Author

N74-10285* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SOLAR IMAGE, CORONA AND RADIATION SIMULATIONS FOR THE APOLLO TELESCOPE MOUNT DISPLAYS OF THE SKYLAB SIMULATOR

Anibal J. DaSilva, George Gause (Aero Service Corp.), and Robert J. Nobilini (Aero Service Corp.) *In its* Space Simulation, 7th 1973 p 795-810 (For availability see N74-10232 01-11)

CSCL 14B

An objective of the Skylab simulator is to train crews to point the solar telescopes of the Apollo telescope mount and to recognize, select and record solar activities. The simulator utilizes hydrogen-alpha photography and correlated simulations of predicted emissions from regions of the solar spectrum as data sources for the displays of the simulator's control and display panel. Analog servoes with digital feedback enable precision pointing at selected solar features viewed on the visual displays. Development and utilization of solar activity simulations from a visual aspect are considered Author

N74-10286* California Univ., Riverside.

A NOVEL 20 kW SOLAR SIMULATOR DESIGNED FOR AIR POLLUTION RESEARCH

J. H. Beauchene (Aerospace Controls Corp.), P. J. Bekowies, J. M. McAfee, A. M. Winer, L. Zafonte, and J. N. Pitts *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 811-825 refs (For availability see N74-10232 01-11)

CSCL 14B

An atmospheric chamber facility for the study of photochemical air pollution at ambient pollutant concentrations has been established. The facility consists of two environmental chambers and a 20 KW solar simulator. The properties and detailed performance characteristics of the solar simulator, including beam intensity, spectrum, uniformity and collimation, are described. Author

N74-10287* General Electric Co., Philadelphia, Pa.
A NOVEL FACILITY FOR RADIANT HEAT TRANSFER EXPERIMENTS
J. Metzger *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 827-846 refs (For availability see N74-10232 01-11)
CSCL 14B

In order to perform a special experiment in radiant heat transfer a unique facility was designed and built. The fundamental design parameters included the capability for achieving rapid initial temperature rise and for establishing effective maximum temperature as high as possible for continuous operation. A particular experiment measuring the emittance of a titanium alloy is summarized. Author

N74-10288* Northrop Services, Inc., Houston, Tex.
A VERSATILE INSTRUMENT FOR THERMAL RADIATION MEASUREMENT **c14**
Calvin M. Wolff *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 847-854 (For availability see N74-10232 01-11)
CSCL 14B

A radiometer has been designed, fabricated, and tested which is rugged, versatile, and highly reliable for measurement of real or simulated solar radiation in an ambient or vacuum environment, and for measurement of total hemispherical infrared radiation in a vacuum. This radiometer may be considered as an all purpose radiometer for space environment simulation and testing. Author

N74-10289* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED SPATIAL UNIFORMITY OF BEAM-PLANE INTERACTION BY MEANS OF INVERSE RASTERING **c24**
Charles G. Miller *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 855-866 refs (For availability see N74-10232 01-11)
(Contract NAS7-100)
CSCL 20H

An analysis is presented that shows the desirability and feasibility of conducting irradiations of large test objects by beams of penetrating radiation, by the method of moving the test object back-and-forth through the beam, rather than by sweeping the beam across the object. An extension of this method of inverse rastering allows the generation of composite beams with any desired intensity-vs-energy spectrum, obviating the need to determine equivalent damage factors for every energy in the spectrum. Author

N74-10290* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ABSOLUTE TOTAL RADIATION RADIOMETER FOR MEASURING A WIDE RANGE OF IRRADIANCES IN SPACE SIMULATORS **c14**
J. M. Kendall, Sr. *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 867-874 refs (For availability see N74-10232 01-11)
CSCL 14B

The combination of a radiometer and the associated control unit provides an accurate and convenient means for making measurements of irradiance of total radiation. The radiometer has been in use in space chambers for monitoring simulated solar irradiances of all spacecrafts tested during this time. Author

N74-10291* Martin Marietta Corp., Denver, Colo.
QUALIFICATION OF NONMETALLIC MATERIALS FOR THE VIKING MARS LANDER **c18**
W. K. Johnson and J. Y. K. Peng *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 875-891 refs (For availability see N74-10232 01-11)
CSCL 11D

The Viking Mars mission has several unique environmental aspects that impose requirements on materials greatly surpassing those of previous space missions. Foremost among these requirements are: (1) The ability of all materials in the spacecraft to withstand exposures to 125 C for up to 100 hours without any deleterious effects; (2) a minimal or predictable change in material properties after 10 to 14 months exposure to the thermal vacuum environment of interplanetary space; and (3) noninterference by materials of life detection and organic analysis experiments to be conducted on the surface of Mars. These requirements formed the basis for an elaborate materials qualification program. Author

N74-10292* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
SPHERE FORMING IN ZERO GRAVITY **c15**
W. Audin, D. Larson, Jr., G. Busch, and G. I. Geschwind *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 893-907 refs (For availability see N74-10232 01-11)
CSCL 13H

Melting and solidification of melted spheres in zero-gravity were studied in a 300 foot drop tower. An apparatus to melt and solidify metals in the three seconds of zero-gravity time available is described. Author

N74-10293* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
A NEW METHOD FOR DETERMINING THE ABSORPTIVITY AND EMISSIVITY OF METAL WIRES **c17**
A. Lorenz and H. P. Schmidt *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 909-918 (For availability see N74-10232 01-11)
CSCL 11F

Special problems in connection with the high solar intensities affecting space probe Helios caused investigations of the real energy consumption of thin wires and the arising temperatures. As the values for absorptivity and emissivity must be considered as uncertain, especially for temperatures up to 700 C, a direct measurement procedure became necessary. At the same time also the individual qualities of the wires, as for instance the influence of the surface quality, could thus be determined. Author

N74-10294* Northrop Services, Inc., Houston, Tex.
HEAT TRANSFER AT SUBATMOSPHERIC PRESSURES, 1 **c33**
Calvin M. Wolff and Thakor J. Vyas *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 919-933 refs (For availability see N74-10232 01-11)
CSCL 20M

Heat transfer rates are measured between surfaces at conditions experienced in space environment simulation chambers in order to obtain data more directly applicable to space environment and cryogenic applications, using large temperature differentials and distances between surfaces of up to 40 cm. Two surfaces were investigated, matte black velvet and aluminized Kapton, to provide extreme cases. The gas evaluated in this study was nitrogen. Author

N74-10295* Los Alamos Scientific Lab., N.Mex.
A ROCKET-BORNE, LOW GRAVITY CRYOGENIC HEAT TRANSFER EXPERIMENT **c33**
K. D. Jr. Williamson, F. J. Edeskuty, and J. F. Taylor *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 935-942 refs Sponsored by AEC (For availability see N74-10232 01-11)
CSCL 20M

In order to obtain steady state data on nucleate boiling heat transfer to liquid helium in a nearly zero gravity environment, a rocket borne experiment was designed, built and successfully flown. A description of the apparatus and flight is presented along with preliminary results. Author

N74-10296* Martin Marietta Corp., Denver, Colo.
TEMPERATURE RISE FOR SPRING-LOADED PHASE CHANGE DEVICES **c33**
R. A. Farmer *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 943-953 refs (For availability see N74-10232 01-11)
CSCL 20M

Solid-to-liquid phase change materials (PCM) that may find use on planetary probes are examined. In this application, the PCM will perform only through the melting cycle to postpone

the overheating of equipment within the probe. One way to minimize temperature rise is to maintain solid phase contact melting. Resulting flow conditions in the liquid PCM film and temperature rise across the film are derived. The significance of the resulting equations, and ways suggested by them to reduce temperature rise, are discussed. Experimental data available are compared to calculated results. Author

N74-10297*# Grumman Aerospace Corp., Bethpage, N.Y.
USER'S GUIDE FOR A COMPUTER PROGRAM TO ANALYZE THE LRC 16 FT TRANSONIC DYNAMICS TUNNEL CABLE MOUNT SYSTEM
P. Barbero and J. Chin [1973] 205 p refs
(Contract NAS1-10635)
(NASA-CR-132313) Avail: NTIS HC $12.25 CSCL 14B

The theoretical derivation of the set of equations is discussed which is applicable to modeling the dynamic characteristics of aeroelastically-scaled models flown on the two-cable mount system in a 16 ft transonic dynamics tunnel. The computer program provided for the analysis is also described. The program calculates model trim conditions as well as 3 DOF longitudinal and lateral/directional dynamic conditions for various flying cable and snubber cable configurations. Sample input and output are included. Author

N74-10298*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ENVIRONMENTAL STATEMENT FOR THE GEORGE C. MARSHALL SPACE FLIGHT CENTER AND MISSISSIPPI TEST FACILITY
Oct. 1972 70 p Original contains color illustrations
(NASA-TM-X-69369) Avail: NTIS HC $5.50 CSCL 14B

The environmental impact was investigated for the George C. Marshall Space Flight Center, and the Mississippi Test Facility. The installations are described, and the missions, environmental impact, and commitment of resources are discussed. It is concluded that there are negligible adverse environmental effects related to these two installations. F.O.S.

N74-10299*# Singer Co., Little Falls, N.J.
QUASI-OPTIMUM DESIGN OF A SIX DEGREE OF FREEDOM MOVING BASE SIMULATOR CONTROL SYSTEM
Bernard Friedland, Chong-Kuan Ling, and Maurice F. Hutton Washington NASA Oct. 1973 152 p refs
(Contract NAS2-3636)
(NASA-CR-2312) Avail: NTIS HC $4.75 CSCL 14B

The design of a washout control system for a moving base simulator is treated by a quasi-optimm control technique. The broad objective of the design is to reproduce the sensed motion of a six degree of freedom simulator as accurately as possible without causing the simulator excursions to exceed specified limits. A performance criterion is established that weights magnitude and direction errors in specific force and in angular velocity and attempts to maintain the excursion within set limits by penalizing excessive excursions. A FORTRAN routine for relizing the washout law was developed and typical time histories using the washout routine were simulated for a range of parameters in the penalty- and weighting-functions. These time histories and the listing of the routine are included in the report. Author

N74-10300*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
NASA-6 ATMOSPHERIC MEASURING STATION
20 Jul. 1973 82 p
(NASA-TM-X-69402; KSC-GP-1013) Avail: NTIS HC $6.25 CSCL 14B

Information required to calibrate, functionally check, and operate the Instrumentation Branch equipment on the NASA-6 aircraft is provided. All procedures required for preflight checks and in-flight operation of the NASA-6 atmospheric measuring station are given. The calibration section is intended for only that portion of the system maintained and calibrated by IN-MSD-12 Systems Operation contractor personnel. Maintenance is not included. Author

N74-10301*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPENSATION BASED ON LINEARIZED ANALYSIS FOR A SIX DEGREE OF FREEDOM MOTION SIMULATOR
Russell V. Parrish, James E. Dieudonne, Dennis J. Martin, Jr., and James L. Copeland Washington Nov. 1973 37 p refs
(NASA-TN-D-7349; L-9023) Avail: NTIS HC $3.00 CSCL 14B

The inertial response characteristics of a synergistic, six-degree-of-freedom motion base are presented in terms of amplitude ratio and phase lag as functions of frequency data for the frequency range of interest (0 to 2 Hz) in real time, digital, flight simulators. The notch filters which smooth the digital-drive signals to continuous drive signals are presented, and appropriate compensation, based on the inertial response data, is suggested. The existence of an inverse transformation that converts actuator extensions into inertial positions makes it possible to gather the response data in the inertial axis system. Author

N74-10302*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
INSTITUTIONAL ENVIRONMENTAL IMPACT STATEMENT (SPACE SHUTTLE DEVELOPMENT AND OPERATIONS) AMENDMENT NO. 1
Aug. 1973 148 p refs
(NASA-TM-X-69471) Avail: NTIS HC $9.50 CSCL 14B

Data are presented to support the environmental impact statement on space shuttle actions at Kennedy Space Center. Studies indicate that land use to accommodate space shuttle operations may have the most significant impact. The impacts on air, water and noise quality are predicted to be less on the on-site environment. Considerations of operating modes indicate that long and short term land use will not affect wildlife productivity. The potential for adverse environmental impact is small and such impacts will be local, short in duration, controllable, and environmentally acceptable. Author

N74-10303# Weapons Research Establishment, Salisbury (Australia).
THE IMPROVEMENT IN MACH NUMBER DISTRIBUTION AND REDUCTION OF PRESSURE FLUCTUATIONS IN THE TRANSONIC WORKING SECTION OF WIND TUNNEL S.1
E. R. A. Landers and P. G. Marshallsay Apr. 1973 19 p refs
(WRE-TN-925) Avail: NTIS HC $3.00

A set of slotted top and bottom liners was used to generate transonic speeds in tunnel S.1 at Weapons Research Establishment. Model supports normally used for supersonic speeds were found to have a large influence on the Mach number distribution and were redesigned to minimize interference to the flow in the working section. Excessive pressure fluctuations were traced to unsteady flow in the cavity between the end of the transonic liners and the diffuser entry. Fairings fitted to this section have greatly reduced the magnitude of the pressure fluctuations. Author

N74-10304# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
LATERAL DISTRIBUTION OF AIRCRAFT TRAFFIC Final Report, Jun. 1970 - Jul. 1971
Donald N. Brown and Owen O. Thompson Jul. 1973 64 p refs
(AD-765435; AEWES-Misc-Paper-S-73-56) Avail: NTIS CSCL 01/5

In the development of pavement design and evaluation criteria for aircraft with complex gear configurations (C-5A, B-747, etc.), it has been revealed that current procedures for relating aircraft operations (passes) to pavement coverages (stress and/or deflection repetitions) are cumbersome and inaccurate. The procedure for converting aircraft passes to pavement coverage has been reexamined by developing theoretical normal traffic distribution curves and fitting these curves to the limited number of actual traffic distribution curves available for four aircraft (B-47, B-52, KC-97, and KC-135). In this manner, more realistic pass-to-coverage (p/c) ratios have been developed for most currently used military and civil aircraft. The revised p/c ratios are presented and are recommended for use in pavement design and evaluation criteria. (Modified author abstract) GRA

N74-10305# Stanford Research Inst., Menlo Park, Calif.
STUDY OF A MAGNETICALLY LEVITATED VEHICLE Final

Report
H. T. Coffey, J. D. Colton, and K. D. Mahrer Feb. 1973 103 p refs
(Contract DOT-FR-10001)
(PB-221696/8; DOT-FR-73-24) Avail: NTIS HC $5.45 CSCL 13F

The objective of this program was to design and construct a magnetically leviated test vehicle whose motion was unrestricted in all degrees of freedom except in the direction of motion, and to make elementary measurements of the motion of the vehicle after traversing vertical and lateral off-sets in the guideway. The vehicle constructed fulfilled these requirements and consisted of a platform leviated by four superconducting magnets contained in liquid helium dewars. Position and acceleration sensors and a telemetry package were on board. The vehicle was towed by a winch at speeds up to 12 m/s (approximately 27 mph). Tests were performed on a 400-ft long aluminum guideway. GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N74-10306 Utah Univ., Salt Lake City.
HINDERED FLOW OF MASSES OF GAS BUBBLES IN A LIQUID Ph.D. Thesis
Tae Hee Lee 1972 319 p
Avail: Univ. Microfilms Order No. 73-12894

The phenomenon of vertical gas-liquid two phase flow was investigated for the flow regimes of bubbly, slug, and froth flow, where the gas phase was dispersed and the liquid phase was continuous. An attempt was made to eliminate the heat and mass transfer problems so that the two-phase system could be observed purely from the fluid dynamics point of view. From the observed data, a semi-empirical equation was formulated for the correlation of average gas holdup, regardless of flow pattern, with other easily measurable variables and/or existing data. This study, besides providing experimental data for future equipment design, clarified much of the contradictions existing among the available data and among the various theoretical models. Experimental observations were made for an air-water system for cocurrent and countercurrent flows in 10 foot long columns of various sizes ranging from 2 inches to 16 inches in diameter. Dissert. Abstr.

N74-10307 Johns Hopkins Univ., Baltimore, Md.
OBSERVATIONS OF INTERMEDIATE AND SMALL SCALE TURBULENT WATER MOTION IN THE PRESENCE OF TIDAL ESTUARY, VOLUMES 1 AND 2 Ph.D. Thesis
Raymond Carlton Seitz 1972 339 p
Avail: Univ. Microfilms Order No. 73-12170

A series of measurements are reported of the three dimensional convected turbulent flow in the Patuxent estuary with a Doppler shift type of current meter. The Doppler shift current meter is capable of sensing the motion in convected fields of turbulence over a wide range of scales. The measurements have provided considerable information about the nature of the three dimensional fields of turbulent energy and about the structure of the high wave number turbulent motion in the tidal estuary. Dissert. Abstr.

N74-10308 Michigan Univ., Ann Arbor.
LASER-DOPPLER ANEMOMETER MEASUREMENTS OF TURBULENCE IN DRAG REDUCING FLOWS PhjD. Thesis
Gordon Lee Guenterberg 1972 101 p
Avail: Univ. Microfilms Order No. 73-11131

The drag reduction, mean flow, and turbulence properties of several concentrations of Separan AP30 and water in a fully developed turbulent pipe flow were studied using a two-component laser-Doppler anemometer. The equations developed for the two component (axial and radial directions) optical geometry show that after initial processing with readout units specially developed for laser anemometry, the two resulting signals may be analyzed with the same equipment used for the analysis of X-wire signals in hot-wire anemometry. An optical bench was designed to meet the spatial requirements of photomixing and to minimize the effects of instrumental broadening as well as to offer ease of alignment and set-up. The spatial requirements of photomixing and instrumental and turbulence broadening were studied and were found to be met and minimized. Dissert. Abstr.

N74-10309 National Lending Library for Science and Technology, Boston Spa (England).
SOME THEORETICAL STUDIES ON THE STABILITY OF A CONTRACTING LIQUID JET
T. Takahashi and Y. Kitamura Jul. 1973 19 p refs Transl. into ENGLISH from Kagaku Kogaku (Tokyo), v. 35, no. 11, 1971 p 65-70 (1229-1234)
(NLL-RTS-7,744) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.80 or 6 NLL photocopy coupons

An analysis was made of the breakup length of a liquid jet under laminar flow, based on the theory of stability. Also analyzed were the breakup length of a laminar flowing liquid jet, whose diameter contracts on flowing downward in a perpendicular direction, and the diameter of a liquid droplet formed by the breakup of such a liquid jet. The effects of various factors affecting these points were studied. Author

N74-10310 Engineering Sciences Data Unit, London (England).
DRAG OF STREAMLINE SOLIDS OF REVOLUTION (TRANSITION AT 0.2l BEHIND NOSE)
Jul. 1973 3 p ref
(ESDU-Bodies-02.04.03-Amend-A) Copyright. Avail: Issuing Activity

The total drag coefficient of streamline solid bodies of revolution, with transition from laminar to turbulent flow at 0.2l behind the nose, is plotted against Reynolds number for various diameter/length ratios. Total drag coefficients are determined relative to the surface area of the body. Examples are given. Author

N74-10311 Engineering Sciences Data Unit, London (England)
DRAG OF STREAMLINE SOLIDS OF REVOLUTION (TRANSITION AT NOSE)
Jul. 1973 3 p ref
(ESDU-Bodies-02.04.01-Amend-A) Copyright. Avail: Issuing Activity

The total drag coefficient for streamline solids of revolution with the transition from laminar to turbulent flow at the nose was determined and graphed against Reynolds number for various diameter/length ratios. The total drag coefficient is based on the surface area (wetted surface) of the body. An aerodynamically smooth surface is assumed. The curves are not applicable if the boundary layer separates from the body appreciably ahead of the tail. This is the case when the diameter/length ratio is more than about 0.3. Author

N74-10312 Engineering Sciences Data Unit, London (England).
DRAG OF STREAMLINE SOLIDS OF REVOLUTION (TRANSITION AT 0.1l BEHIND NOSE)
Jul. 1973 2 p ref
(ESDU-Bodies-02.03.02-Amend-A) Copyright. Avail: Issuing Activity

The total drag coefficient of streamline solid bodies of revolution, with transition from laminar to turbulent flow a 0.1l behind the nose, is plotted against Reynolds number for various diameter/length ratios. Total drag coefficients are determined relative to the surface area of the body. Examples are given. Author

N74-10313 Engineering Sciences Data Unit, London (England).
ONE DIMENSIONAL ISENTROPIC GAS FLOW
May 1970 11 p refs
(ESDU-00.03.07) Copyright. Avail: Issuing Activity

A numerical analysis of one-dimensional isentropic gas flow is presented. The mathematical models for the parameters of a perfect gas are developed. Specific examples of gas flow analysis

to show the use of various tables and coefficients are provided. Specific characteristics are displayed as graphs. Author

N74-10314 Engineering Sciences Data Unit, London (England).
WALL AND AVERAGE GAS TEMPERATURES FOR SUBSONIC TURBULENT FLOW WITH HEAT TRANSFER IN DUCTS OF CONSTANT CIRCULAR CROSS SECTION
Apr. 1973 11 p refs
(ESDU-00.03.26) Copyright. Avail: Issuing Activity

The variations of wall and gas temperatures along the length of a pipe are determined for the subsonic turbulent flow of a perfect gas under conditions of forced convection heat transfer. It is assumed that the rates of heat flux are sufficiently low for the gas properties to be sensibly constant. Simple calculations are presented for the thermal boundary conditions of uniform heat flux and constant wall temperature. The variation of the wall and average gas temperatures along the duct are effectively computed by analyzing an equivalent one dimensional flow having the same mass flow rate and flux of energy. Author

N74-10315 Texas A&M Univ., College Station.
VELOCITY AND PRESSURE DISTRIBUTIONS AROUND AN OBSTACLE IN OPEN CHANNEL FLOWS Ph.D. Thesis
Michel Antoun Raphael 1972 279 p
Avail: Univ. Microfilms Order No. 73-12286

A thorough investigation of the Marker and Cell technique was conducted. The investigation is related to the overall validity of that technique. The modified technique that resulted from this research is labelled TAMMAC. The different areas studied are: pressure and velocity fields, boundary conditions on the free surface and on the boundaries, and the use of a real viscosity. The application of different computational aspects such as upwind and downwind, particle motion, and free surface location are also studied. Both a Gaussian elimination scheme and an over-relaxation scheme were used for the solution of the pressure field. An optimum over-relaxation parameter of 1.65 was used. The pressure distributions in the field were plotted and the use of the D-terms in Poisson's equation was not found to be a necessary condition for the stability of the field nor the order of magnitude of the pressures, even though such terms constitute a highly stabilizing factor. Dissert. Abstr.

N74-10316# Toronto Univ. (Ontario). Dept. of Mechanical Engineering.
DIGITAL ANALYSIS OF TURBULENT SIGNALS
J. G. Kawall and J. F. Keffer Apr. 1971 92 p refs
(UTME-TP-7104) Avail: NTIS HC $6.75

A technique of analyzing turbulent signals to obtain estimates of one dimensional energy spectra and autocovariance functions is examined. The technique is computer-oriented, and uses as a basis, the Fourier transform. The practical application is effected by means of a fast Fourier transform algorithm, which may be described simply as a highly efficient and accurate method of computing the Fourier transform defined on finite, equispaced, discrete sequences. Author

N74-10317# National Aeronautical Establishment, Ottawa (Ontario).
ON ATOMIZATION AND LINEARIZED FREE-SURFACE INSTABILITY ON ROTATING BODIES
A. M. Drummond Jun. 1972 29 p refs
(NRC-12765) Avail: NTIS HC $3.50

A surface wave instability theory applicable to spinning disks and cups is presented and a new explanation of atomization from these devices is proposed. The theory predicts an unstable disturbance wavelength that correlates with experimental results of Hinze and Milborn for ligament formation from a rotating cup. The linear analysis is restricted to flows where perturbation amplitude is much less than film thickness. Author

N74-10318*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF GEOMETRY VARIATIONS ON LEE-SURFACE VORTEX-INDUCED HEATING FOR FLAT-BOTTOM THREE-DIMENSIONAL BODIES AT MACH 6
Jerry N. Hefner Washington Nov. 1973 30 p refs
(NASA-TN-D-7447; L-9209) Avail: NTIS HC $3.00 CSCL 20D

Studies have shown that vortices can produce relatively severe heating on the leeward surfaces of conceptual hypersonic vehicles and that surface geometry can strongly influence this vortex-induced heating. Results which show the effects of systematic geometry variations on the vortex-induced lee-surface heating on simple flat-bottom three-dimensional bodies at angles of attack of 20 deg and 40 deg are presented. The tests were conducted at a free-stream Mach number of 6 and at a Reynolds number of 1.71 x 10 to the 7th power per meter. Author

N74-10319*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MEASUREMENTS AND A MODEL FOR CONVECTIVE VELOCITIES IN THE TURBULENT BOUNDARY LAYER
William C. Cliff and Virgil A. Sandborn Washington Oct. 1973 142 p refs
(NASA-TN-D-7416) Avail: NTIS HC $4.50 CSCL 20D

A physical model is presented which describes convective velocities within a flat plate turbulent boundary layer. A production zone concept is used as a basis for the physical model. The production zone concept employs the idea that packets of turbulent fluid are generated near the viscous sublayer. These packets are found to be discernible from the mean motion and may move either outward from the production zone or inward depending on their circulation relative to the fluid surrounding the packet. The packets are predicted to travel with a convective velocity different from the local mean velocity throughout most of the boundary layer. The model also predicts that the convective velocities will be functions of wave number outside the production zone. Author

N74-10320# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
LARGE AMPLITUDE, LOW FREQUENCY SOLUTIONS FOR A CERTAIN CLASS OF LAMINAR BOUNDARY LAYER PROBLEMS
James C. Williams, III 29 Oct. 1973 27 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Mar. 1974
(Grant DA-ARO(D)-31-124-72-G134)
Avail: NTIS HC $3.50 CSCL 20D

A study was made of a class of unsteady laminar boundary layer flows. Such flows occur when a non-lifting body moves through a fluid at a varying speed but with fixed orientation with respect to the free steam velocity vector. If the external velocity is of this form both the steady state (m(t) = 1) and the quasi-steady boundary layer solutions are governed by the same equation. If m(t) is periodic and the reduced frequency is small, the unsteady solution may be obtained as a series expansion, in the reduced frequency, about the quasi-steady solution. Results are obtained for three bodies and it is shown that the unsteady effects are most prominent in the region of adverse pressure gradient. When m(t) is periodic the unsteady shear leads the quasi-steady shear. These results are explained in terms of the local unsteady pressure gradient. Author

N74-10321*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MINIMIZING BOUNDARY LAYER BLEED FOR A MIXED COMPRESSION INLET
Joseph F. Wasserbauer, Robert J. Shaw, and Harvey E. Neumann 1973 21 p refs Presented at Propulsion Joint Specialist Conf., Las Vegas, Nev., 5-7 Nov. 1973; cosponsored by AIAA and SAE
(NASA-TM-X-71461; E-7757) Avail: NTIS HC $3.25 CSCL 20D

An experimental investigation of a full scale mixed compression inlet sized for the TF30-P-3 turbofan engine was conducted at Mach 2.5 and 2.0 operating conditions. The two cone axisymmetric inlet had minimum internal contraction consistent with high total pressure recovery and low cowl drag. At Mach 2.5, inlet recovery exceeded 0.90 with only 0.02 centerbody bleed mass-flow ratio and zero cowl bleed. A centerbody bleed of approximately 0.05 gave a maximum inlet unstart angle-of-attack of 6.85 deg. Inlet performance and angle-of-attack tolerance is presented for operation at Mach 2.5 and 2.0. Author

N74-10322# National Aerospace Lab., Tokyo (Japan).
EXPERIMENTAL INVESTIGATION OF TWO-DIMENSIONAL CASCADE PERFORMANCE WITH BLUNT TRAILING EDGE BLADE SECTIONS AT TRANSONIC INLET MACH NUMBER RANGE
Hajime Sakaguchi, Hiroshi Kondo, Susumu Takamori, and Keigo Iwashita Mar. 1973 53 p refs In JAPANESE; ENGLISH summary
(NAL-TR-313) Avail: NTIS HC $4.75

The cascade performance of blunt trailing edge blades with camber angles of 12 and 35 degrees were investigated at Mach numbers from 0.6 to 1.4 over the range of incidence angles up to a positive stall in a transonic cascade wind tunnel. The test Reynolds number range was 300,000 to 800,000 based on the blade chord. Experiments were made with the boundary layer suction from porous side walls at the test section to establish two-dimensional flow in the cascade. Total pressure and flow angle measurements were made by traversing a five hole probe in the outlet flow from the cascade. Author

N74-10323# National Aerospace Lab., Tokyo (Japan).
AN EVALUATION OF SEVERAL DIFFERENCE METHODS FOR COMPRESSIBLE NAVIER-STOKES EQUATIONS
Tomiko Ishiguro Mar. 1973 52 p refs In JAPANESE; ENGLISH summary
(NAL-TR-310) Avail: NTIS HC $4.75

Several finite difference methods are constructed for initial boundary value problems which are considered appropriate for numerical integrations of the one- and the two-dimensional Navier-Stokes equations for unsteady compressible flow. Both the von Neumann conditions on stability and the consistency conditions on accuracy are obtained. The time dependent flow field patterns around a semi-infinite plate, which is settled on the center line of the two dimensional shock tube, are successfully sketched numerically by means of the difference methods constructed. Author

N74-10324# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
AN EXPERIMENTAL EXPLANATION OF NORTHERN GERMAN SALT STRUCTURES BY A SIMPLE HYDRODYNAMIC MODEL [VERSUCH DER ERKLAERUNG NORDDEUTSCHER SALZSTRUKTUREN MIT EINEM EINFACHEN HYDRODYNAMISCHEM]
Hildegard Saalfrank 1973 77 p refs In GERMAN
Avail: NTIS HC $6.00

The linearized Navier-Stokes equation is utilized to formulate a two layer hydrodynamic model of constant densities and equivalent viscosities for the analytical solution to the salt dome structure problem. This parametric model incorporates lift dimensions and dominant wave length of the disturbance propagation in the instable sediment-salt system.
Transl. by G.G.

N74-10325*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND ANALYTICAL STUDY OF A CONICALLY DIFFUSED FLOW WITH A NEARLY SEPARATED BOUNDARY LAYER
Donald R. Boldman and Harvey E. Neumann Washington Nov. 1973 41 p refs
(NASA-TN-D-7486; E-7423) Avail: NTIS HC $3.00 CSCL 20D

Turbulence measurements were obtained in the nearly separated flow in a 13 deg total angle of divergence conical diffuser coupled to a constant area tailpipe. Air at 207 newtons per square centimeter and 308 K provided an inlet velocity of about 51 meters per second at an inlet unit Reynolds number of 63.7 million per meter. Very high longitudinal turbulence intensities accompanied the diffusion process with peak values approaching 40 percent when normalized by the local centerline velocity. Predictions of the pressure recovery coefficient using a mixing length concept were good in the early stages of diffusion. In the latter stages of diffusion satisfactory predictions of the pressure recovery were obtained with an empirical method.
Author

N74-10326# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF THE LONGITUDINAL DISTURBED MOTION OF A SURFACE SKIMMER
E. P. Vachasov and G. F. Kurochka 6 Aug. 1973 15 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 29, 1972 p 7-13
(AF Proj. G101)
(AD-765992; FTD-HT-23-587-73) Avail: NTIS CSCL 20/4

The longitudinal disturbed motion of a surface skimmer, like that of common aircraft, is determined by the following processes: By varying the magnitude of the velocity of the center of gravity; By varying the direction of flight; and by rotating the aircraft relative to the Oz axis which passes through its center of gravity. These processes are interconnected and are examined together.
GRA

N74-10327# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORY OF SUPERSONIC GAS FLOWS
G. G. Chernyi 25 Jul. 1973 59 p Transl. into ENGLISH of the mono. "Mekhanika v SSSR za 50 Let" USSR, v. 2, 1970 p 161-165, 181-206
(AD-765993; FTD-MT-24-321-73) Avail: NTIS CSCL 20/4

A Russian examination of supersonic flow is presented, including the equations of motion, thermal properties, stream functions, potential flow, velocity modulus, shock waves, mathematical models, cross sectional characteristics, geometric forms, model tests, flow stabilization, and problem solving. GRA

N74-10328# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE EFFECT OF GRIDS ON THE CHARACTERISTICS OF A TURBULENT FLOW
V. A. Lebiga and V. V. Chernykh 6 Aug. 1973 17 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. akad. Nauk SSSR (Novosibirsk), no. 8, Jun. 1972 p 47-53
(AF Proj. G101)
(AD-765999; FTD-HT-23-585-73) Avail: NTIS CSCL 20/4

Certain structural measures make it possible to obtain a uniform flow in a wind tunnel test section with a low degree of turbulence. One of these measures is grids in the prechamber of the wind tunnel which equalize the fields of average speed and reduce the intensity of turbulent fluctuations. This article gives the results of an investigation on the effect of the specific resistance of a grid and a number of grids in sequence on reduction of the turbulent fluctuations in speed. GRA

N74-10329# Harry Diamond Labs., Washington, D.C.
TWO-DIMENSIONAL, INCOMPRESSIBLE, TURBULENT CURVED-WALL JETS
G. Mon and H. Ping Pao (Catholic Univ.) May 1973 34 p refs
(DA Proj. 1T0-61102-A-33B; HDL Proj. 302331)
(AD-766164; HDL-TM-72-34) Avail: NTIS CSCL 20/4

When a jet flows adjacent to a solid boundary, it tends to attach itself and flow along the surface. A theoretical and experimental study of the effects of the surface curvature on the flow field of a two-dimensional, incompressible, turbulent jet has been made. By using a perturbation technique, the governing equations for the flow have been obtained and solved numerically. There is flow similarity for a curved-wall jet when m = 1, and for the flow of a plane wall jet when the curvature approaches infinity. Two spiral and three circular cylindrical surfaces were tested. The mean velocity profiles and static pressure distributions were measured at various stations for each surface. In addition, the point of separation was found for Reynolds numbers, based on the nozzle width, in the range of 500 to 4000. The growth rates of the jet width and the rate of decay of the maximum velocity were deduced from the velocity measurements. (Modified author abstract) GRA

N74-10330# Army Foreign Science and Technology Center, Charlottesville, Va.
APPLICATION OF THE LYAPUNOV THEORY TO THE INVESTIGATION OF BOUNDARY LAYER INSTABILITY
L. M. Maseev 6 Jul. 1973 17 p refs Transl. into ENGLISH from Tr. Inst. Mosk. Inzh. Zheleznodorozhnogo Transp. (Moscow),

no. 361, 1970 p 7-14
(AD-766167; FSTC-HT-23-2425-72) Avail: NTIS CSCL 20/4

The report discusses the stability of a flow formed in the boundary layer after the formation of palne Tollman-Schichtling waves in the layer. Author (GRA)

N74-10331# Army Foreign Science and Technology Center, Charlottesville, Va.

HEAT TRANSFER AT AN INITIAL HEAT SEGMENT FOR STABILIZED TURBULENT AIR FLOW IN CIRCULAR TUBES AND RECTANGULAR CHANNELS

V. M. Legkii 13 Mar. 1973 13 p refs Transl. into ENGLISH from Inz.-Fiz. Zh. (USSR), v. 20, 1971 p 215-223
(AD-766170; FSTC-HT-23-2003-72) Avail: NTIS CSCL 20/4

Based on a generalization of experimental data, formulas are proposed for the calculation of local and mean heat transfer for the thermal initial section when turbulent air flow is stabilized in circular tubes and in rectangular channels. GRA

N74-10332# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.

AN EXPERIMENTAL INVESTIGATION OF THE HEAT TRANSFER CHARACTERISTICS OF A HEATED CYLINDER PLACED IN A CROSS FLOW OF AIR M.S. Thesis

John Ferrandello Meyer Jun. 1973 132 p refs
(AD-765682) Avail: NTIS CSCL 20/4

Local heat transfer and pressure coefficients around a right circular cylinder were experimentally determined at Reynolds numbers ranging from 57,000 to 495,000. The turbulence intensity of the free stream was approximately 0.5%. The cylinder was heated externally with a constant heat flux and simultaneously cooled in a cross flow of air. The steady state surface temperature increase above the air temperature was indicated by thermocouple information. Employing Newton's law of cooling, heat transfer coefficients were determined as a function of the angular location from the forward stagnation line. A comparison is made between the heat transfer and pressure data collected. (Modified author abstract) GRA

N74-10333# Army Foreign Science and Technology Center, Charlottesville, Va.

EFFECT OF A TRANSVERSE MASS FLOW ON HEAT TRANSFER AND DYNAMICS OF A TURBULENT HOT AIR FLOW IN AXISYMMETRIC DIFFUSOR WITH A PERMEABLE WALL

P. N. Romanenko 20 Mar. 1973 10 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Belorussian SSR), v. 19, no. 2, 1970
(AD-765858; FSTC-HT-23-1995-72) Avail: NTIS CSCL 20/4

The results of an experimental investigation of heat transfer and flow dynamics of a turbulent flow in an axisymmetric permeable diffuser with uniform transpiration of the coolant through the wall are presented. GRA

N74-10334# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

LAMINAR INCOMPRESSIBLE FLOW PAST BLUNTED WEDGES USING THE NAVIER-STOKES EQUATIONS Interim Report

R. Thomas Davis, Urmila Ghia, and Kirti N. Ghia Jul. 1973 36 p refs
(Contract N00014-72-A-0027-0001)
(AD-765742; AFL-73-7-2) Avail: NTIS CSCL 20/4

The Navier-Stokes equations are solved, numerically, to determine the symmetric laminar incompressible flow past blunted wedges. Similarity-type variables are used in a coordinate system that comprises the optimal coordinates for the corresponding boundary-layer problem. This formulation leads to better numerical accuracy and produces the correct solution near the leading edge, far downstream and transversely far from the wedge surface. The flow over parabolas, the flat plate, and the vertical wall are obtained as particular cases of the present solutions and compare well with the available results for these problems. The numerical method is an implicit alternating direction method that converges rapidly to accurate results. Author (GRA)

N74-10335# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.

A STUDY OF SUPERSONIC FLOW PAST VIBRATING SHELLS AND CASCADES

Christian W. Brix, Jr. Jun. 1973 135 p refs
(AD-765735) Avail: NTIS CSCL 20/4

Supersonic flow past oscillating cylindrical shells and oscillating flat-plate cascades is analyzed using linearized characteristics methods. Pressure distributions and generalized aerodynamic forces are computed for arbitrary radius to length ratios, axial and circumferential wave numbers, Mach numbers, and reduced frequencies. Pressure distributions are computed for flat-plate cascades with supersonic leading edge locus for arbitrary solidity, stagger angle, frequency, and interblade phase angle. For comparison, a two-blade solution is developed using the method of singularities. (Modified author abstract) GRA

N74-10336# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

LAMINAR INCOMPRESSIBLE FLOW PAST SHARP WEDGES

R. Thomas Davis, Urmila Ghia, and Kirti N. Ghia Jul. 1973 28 p refs
(Contract N00014-72-A-0027-0001)
(AD-765741; AFL-73-7-3) Avail: NTIS CSCL 20/4

The symmetric laminar incompressible flow field past wedges with a sharp leading edge has been determined using the Navier-Stokes equations written in a coordinate system that is optimal to second order. Because of a singularity that develops in the skin friction at such a sharp leading edge, the flow at this singular point is calculated from the Stokes approximation to the full equations. The free constant in the Stokes solution is determined by equating the skin friction function from the two solutions at a point, on the stagnation streamline, in the immediate vicinity of the sharp tip. Good agreement is obtained with the available results for the flow past the two limiting cases: the semi-infinite flat plate and the infinite vertical wall. Author (GRA)

N74-10337# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

THE USE OF OPTIMAL COORDINATES IN THE SOLUTION OF VISCOUS FLOW PROBLEMS

R. T. Davis and Urmila Ghia Aug. 1973 33 p refs
(Contract N00014-72-A-0027-0001)
(AD-765740; AFL-73-8-4) Avail: NTIS CSCL 20/4

The idea of optimal coordinates, which was first developed by Kaplun (1954) and later extended by Legner (1971), is extended further in the present work and is used to analyze several viscous flow problems. Optimal coordinates are found for incompressible flow past wedges and cones and for supersonic compressible flow past a flat plate. Author (GRA)

N74-10338# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.

CONTROL FAILURE SIMULATIONS OF THE PHM HYDROFOIL CRAFT USING A 1/20-SCALE DYNAMIC MODEL WITH AUTOMATIC CONTROL Final Report

Charles J. Henry Apr. 1973 47 p refs
(Contract N00014-67-A-0202-0019)
(AD-766098; SIT-DL-73-1662) Avail: NTIS CSCL 13/10

A 1/20-scale model of the PHM hydrofoil craft was developed with automatic control. Heave, pitch and roll motions were controlled by means of flaps on the forward secondary foil and on the port and starboard aft main foils. Motions lateral to the tank were constrained in this phase of the test program. The control system logic also provided for simulations of control system failure wherein any one flap or any combination of flaps can be thrown hard against mechanical stops. Only one flap was failed in any one run in this study. The trajectories subsequent to simulated control system failure were recorded for this five-degree-of-freedom model. Failures which lead to broaching of the bow foil appear to be serious. Failures which lead to hull impact do not appear dangerous. The results are discussed in more detail in the report. Recommendations for further development and utilization of this automatically-controlled, model, hydrofoil-supported platform are discussed. A second test phase with six-degrees-of-freedom and with steering control has been initiated. Author (GRA)

N74-10339# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
CALCULATION OF THE VELOCITY PROFILES OF THE INCOMPRESSIBLE LAMINAR BOUNDARY LAYER ON A YAWED SPINNING CONE AND THE MAGNUS EFFECT
Ira D. Jacobson, Allen G. Vollmer, and J. B. Mortion Aberdeen Proving Ground, Md. Ballistics Res. Lab. Jul. 1973 65 p refs
(Contract DAAD05-72-C-0131; DA Proj. 1T0-61102-A-33D) (AD-766282; ESS-3318-104-73U; BRL-CR-110) Avail: NTIS CSCL 20/4

The incompressible laminar boundary layer on a spinning cone at small angle of attack is investigated. Similarity equations are developed for the incompressible boundary layer and solved numerically. The resultant velocity profiles are then used to obtain the displacement thickness and the resulting magnus effect. Author (GRA)

N74-10340# ARO, Inc., Arnold Air Force Station, Tenn.
AN EXPERIMENTAL INVESTIGATION OF AN ACOUSTIC METHOD FOR MEASURING GAS MASS FLOW Final Report, Jul. 1971 - Jul. 1972
L. J. David and T. L. Giltinan AEDC Sep. 1973 59 p ref Sponsored by AEDC
(ARO Proj. PW5213)
(AD-766419; ARO-PWT-TR-73-5; AEDC-TR-73-140) Avail: NTIS CSCL 14/2

Airflow through the test section of a 1- by 1-ft transonic wind tunnel under subsonic flow conditions was measured by an acoustic method to evaluate feasibility of the method. The method was based on measuring the time of travel of an acoustic signal between a transmitter and a receiver which were located on opposite walls of the tunnel on a line perpendicular to the direction of airflow. An electrical discharge arc-gap transmitter was developed which emits a signal pressure wave with an output intensity significantly greater than that of the tunnel noise. Calibration of the wave velocity increment under quiescent conditions demonstrated good repeatability. (Modified author abstract) GRA

N74-10341# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTL INVESTIGATION OF THE EFFECT OF ADVERSE PRESSURE GRADIENT ON VORTEX BREAKDOWN M.S. Thesis
Gale Edward Treiber Jun. 1973 75 p refs
(AD-765672) Avail: NTIS CSCL 20/4

The results of an experimental investigation of the effect of adverse pressure gradient on the vortex breakdown phenomenon in a diverging tube are presented. Adverse pressure gradient was found to be as significant in determining the breakdown position as were the previously known parameters of Reynolds and circulation numbers. An approximate momentum analysis for predicting the vortex breakdown position was carried out which appears to hold promise as a breakdown predictor. (Modified author abstract) GRA

N74-10342# TRW Systems Group, Redondo Beach, Calif.
A PHENOMENOLOGICAL MODEL FOR THE MOMENTUMLESS TURBULENT WAKE IN A STRATIFIED MEDIUM Final Report, 15 Aug. 1971 - 30 Jun. 1973
D. R. S. Ko Apr. 1973 54 p refs
(Contract N00014-72-C-0074; ARPA Order 1910)
(AD-766148; TRW-20086-6007-RU-00) Avail: NTIS CSCL 20/4

The growth and collapse of the turbulent wake behind a submarine in a stratified ocean is studied analytically using simple phenomenological models. The present analysis closely follows a previous integral approach based on the concept of local similarity and turbulent entrainment. A nonuniform entrainment rate, obtained by considering the three turbulent velocity components separately, marks the main difference to the previous approach. The present analysis is limited to a wake without swirl and does not include the energy leakage through the internal wave field. GRA

N74-10343# Naval Ship Research and Development Center, Bethesda, Md.
EVALUATION OF A ROTATING DISK APPARATUS: DRAG OF A DISK ROTATING IN A VISCOUS FLUID Final Report
John J. Nelka Jul. 1973 48 p refs
(SR0090101)
(AD-766083; NSRDC-3851) Avail: NTIS CSCL 20/4

A rotating disk apparatus, designed to attain high shear stresses comparable to those about hulls of full-scale ships is evaluated. Shear stresses were not measured but were inferred from measurements of disk moments. Two disk surfaces were evaluated, hydraulically smooth and sandpaper rough. For the smooth and rough surface disks in air, the experimental moment coefficients were generally greater than the theoretical predictions. Only the smooth surface disk in water gave results lower than predictions. (Modified author abstract) GRA

N74-10344# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBULENT FLOWS (SELECTED ARTICLES)
V. V. Struminskii, M. L. Filmono, and G. S. Glushko 13 Oct. 1972 170 p refs Transl. into ENGLISH of the publ. "Turbulentnye Techeniya' Moscow, Nauka, 1970
(AD-754323; FTD-MT-24-793-72) Avail: NTIS CSCL 20/4

A series of articles discusses turbulent flows. The overall problem, the stability of laminar flow, and transition to turbulent flow are discussed. Diagram equations for the degeneration of turbulence, and calculations of pressure and velocity fluctuations in the boundary layer are followed by articles on the kinematic characteristics of a turbulent flow during steady motion, pressure fluctuations on the boundary of a turbulent flow, turbulent flows in jets and ducts, and the turbulent mixing of free gas jets. Author (GRA)

N74-10253* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A METHOD FOR PREDICTING BLAST WAVE OVERPRESSURE PRODUCED BY RUPTURE OF A GAS STORAGE VESSEL
P. W. Garrison *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 315-439 refs (For availability see N74-10232 01-11)
CSCL 20D

N74-10267* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SIMULATION OF THREE-DIMENSIONAL COOLANT FLOW WITHIN TRANSPIRATION NOSETIPS
J. R. Schuster and G. E. Seay *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p523-542 refs (For availability see N74-10232 01-11)
CSCL 20D

N74-10443 Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).
FLOW INVESTIGATIONS AT BARREL MUZZLES USING LASER INDUCED GAS MOTION [STROEMUNGSUNTERSUCHUNGEN AN WAFFENMUENDUNGEN MITTELS LASERINDUZIERTEN GASDURCHBRUCHS]
G. A. Schroeder *In* Inst. Franco-Allemand de Rech. Papers on Ballistics and Phys. of Transience 1973 p 140-158 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N74-10345 Wisconsin Univ., Madison.
GEOPHYSICAL INVESTIGATIONS IN MARIE BYRD LAND, ANTARCTICA Ph.D. Thesis
John Edward Beitzel 1972 123 p
Avail: Univ. Microfilms Order No. 73-7178

During the 1966-67 Antarctic field season 4000 nautical miles of aeromagnetic data were collected in Marie Byrd Land,

between 110 deg and 160 deg west longitude and within a 300 km belt along the Amundsen Sea coast. Concurrently, 190 gravity stations were established in the vicinity of the Ford Ranges, principally between 142 deg and 154 deg west longitude and between 76 deg and 78 deg south latitude. Total intensity profiles display narrow, high amplitude anomalies, probably largely associated with Cenozoic volcanics, in a zone stretching from approximately 142 W to 134 W. The residual total intensity map trends suggest a possible geologic province boundary near 142 W, separating the Mesozoic intrusive terrane of the Ford Ranges on the west from the Cenozoic volcanic province to the east. Dissert. Abstr.

N74-10346 Ohio State Univ., Columbus.
ABSORPTION MEASUREMENTS OF THE 10.4 MICRON REGION USING A CO2 LASER AND A SPECTROPHONE Ph.D. Thesis
Gary Lee Trusty 1972 86 p
Avail: Univ. Microfilms Order No. 73-11593

A spectrophone cell and a data acquisition system were developed and used to make low level absorption measurements of carbon dioxide and water vapor. A 1 watt per line carbon dioxide laser was used as the source. Measurements were made of the absorption of the P branch of the 10.4 micron band of CO2. Results of these measurements were used to calculate the self broadened and foreign broadened Lorentz half widths of the lines in that band as of function of the rotational quantum number. The gases used for foreign broadening were nitrogen, argon and helium. Absorption measurements of water vapor-nitrogen mixtures were made in the 10.4 micron region. The absorption coefficient of the continuum in this region was found to have a positive slope with increasing wavenumber. Dissert. Abstr.

N74-10347*# Alaska Univ., Fairbanks. Cooperative Wildlife Research Unit.
APPLICATION OF ERTS-1 IMAGERY TO THE STUDY OF CARIBOU MOVEMENTS AND WINTER DISPERSAL IN RELATION TO PREVAILING SNOWCOVER Bimonthly Progress Report
Peter C. Lent, Principal Investigator 30 Sep. 1973 3 p ERTS
(Contract NAS5-21833)
(E73-11087; NASA-CR-135555) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N74-10348*# Corps of Engineers, Waltham, Mass.
ERTS-1 DATA USER INVESTIGATION OF THE USE OF ERTS IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, 14 Jun. - 14 Aug. 1973
Saul Cooper and Paul Bock, Principal Investigators 15 Sep. 1973 5 p ERTS
(Contract NASA Order S-70256-AG)
(E73-11144; NASA-CR-135703) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N74-10349*# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
INVENTORY OF FOREST AND RANGELAND RESOURCES, INCLUDING FOREST STRESS Monthly Progress Report, 16 Sep. - 15 Oct. 1973
Robert C. Heller, Robert C. Aldrich, Frederick P. Weber, and Richard S. Driscoll, Principal Investigators 16 Oct. 1973 9 p EREP
(NASA Order T-4106-B)
(E73-11166; NASA-CR-135767; MPR-6) Avail: NTIS HC $3.00 CSCL 02F

There are no author-identified significant results in this report.

N74-10350*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE SECOND-ORDER GRAVITATIONAL RED SHIFT Semiannual Progress Report, 15 Nov. 1972 - 14 May 1973
Jack Jaffe Jun. 1973 48 p refs
(Grant NGR-09-015-205)
(NASA-CR-124470; SAPR-1) Avail: NTIS HC $4.50 CSCL 20J

The direct measurement of the nonlinear term of the gravitational field equations by using very stable clocks is discussed along with measuring the perhelion advance of a planet or satellite. These are considered measurements of the second-order gravitational red shift. The exact expression for the frequency shift of light in a gravitational field is derived. Other topics discussed include: The Doppler-cancelling technique; the second-order red shift in a spherically symmetric gravitational field; finite signal transit time; and the reality and interpretation of coordinates in the second-order red shift experiment. F.O.S.

N74-10351*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
INTERHEMISPHERIC COMPARISON OF ATMOSPHERIC CIRCULATION FEATURES AS EVALUATED FROM NIMBUS SATELLITE DATA Semiannual Report, 1 Jul. - 31 Dec. 1972
E. R. Reiter 31 Dec. 1972 16 p refs Submitted for publication
(Grant NGR-06-002-098)
(NASA-CR-132849) Avail: NTIS HC $3.00 CSCL 04A

General circulation parameters in the Northern Hemisphere are calculated using atmospheric thermal structure obtained from Nimbus 3 SIRS multi-channel radiance information. The thermal structure up to 10 mb is obtained by using a regression technique with thickness between pressure levels as the dependent variable. General circulation parameters calculated on a daily basis include zonal and eddy available potential energy, and zonal and eddy kinetic energy. A second set of calculations is performed using National Meteorological Center grid data. A comparison of the two sets of calculations indicates that, although the energies calculated from the SIRS-derived structure underestimate the actual energies, maxima, minima, and trends are well identified. An example of mid-stratospheric energy changes during a breakdown of the polar-night vortex is also given. Author

N74-10352*# National Marine Fisheries Service, Bay Saint Louis, Miss.
OCEANIC GAMEFISH/SKYLAB PROJECT FIELD OPERATING PLAN FOR OPERATIONS 4, 5 AUGUST
27 Jul. 1973 159 p Sponsored by NASA
(NASA-CR-136032) Avail: NTIS HC $10.00 CSCL 08A

The operation plans are presented for the oceanic Gamefish/Skylab Experiment 240, which was conducted to obtain fish catch data for the northeast area of the Gulf of Mexico. The plans for surface measurements, aerial observations, and communications are included. F.O.S.

N74-10353*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
SOME OBSERVED SEASONAL CHANGES IN EXTRATROPICAL GENERAL CIRCULATION: A STUDY IN TERMS OF VORTICITY
Srinivasan Srivatsangam and Elmar R. Reiter Aug. 1973 81 p refs
(Grant NGR-06-002-098)
(NASA-CR-132857; CSU-ATSP-204) Avail: NTIS HC $6.25 CSCL 04A

Extratropical eddy distributions in four months typical of the four seasons are treated in terms of temporal mean and temporal r.m.s. values of the geostrophic relative vorticity. The geographical distributions of these parameters at the 300 mb level show that the arithmetic mean fields are highly biased representatives of the extratropical eddy distributions. The zonal arithmetic means of these parameters are also presented. These show that the zonal-and-time mean relative vorticity is but a small fraction of the zonal mean of the temporal r.m.s. relative vorticity, K. The reasons for considering the r.m.s. values as the temporal normal values of vorticity in the extratropics are given in considerable detail. The parameter K is shown to be of considerable importance in locating the extratropical frontal jet streams (EFJ) in time-and-zonal average distributions. The study leads to an understanding of the seasonal migrations of the EFJ which have not been explored until now. Author

N74-10354*# Bendix Corp., Southfield, Mich.
EOS MAPPING ACCURACY STUDY Final Report, Apr. - Aug. 1972
Robert B. Forrest, Thomas A. Eppes, and Robert J. Ouellette Mar. 1973 138 p refs
(Contract NAS5-21727; BRL Proj. 2516)
(NASA-CR-132820; BRL-6562) Avail: NTIS HC $9.00 CSCL 08B

Studies were performed to evaluate various image positioning methods for possible use in the earth observatory satellite (EOS) program and other earth resource imaging satellite programs. The primary goal is the generation of geometrically corrected and registered images, positioned with respect to the earth's surface. The EOS sensors which were considered were the thematic mapper, the return beam vidicon camera, and the high resolution pointable imager. The image positioning methods evaluated consisted of various combinations of satellite data and ground control points. It was concluded that EOS attitude control system design must be considered as a part of the image positioning problem for EOS, along with image sensor design and ground image processing system design. Study results show that, with suitable efficiency for ground control point selection and matching activities during data processing, extensive reliance should be placed on use of ground control points for positioning the images obtained from EOS and similar programs. Author

N74-10355*# Panametrics, Inc., Waltham, Mass.
FEASIBILITY STUDY FOR ROCKET OZONE MEASUREMENTS IN THE 50 TO 80 KM REGION USING A CHEMILUMINESCENT TECHNIQUE Final Report, Jan. 1971 - Apr. 1972
Philip Goodman May 1973 24 p refs
(Contract NAS5-21593)
(NASA-CR-132824) Avail: NTIS HC $3.25 CSCL 04A

A study has been conducted to determine the feasibility of increasing sensitivity for ozone detection. The detection technique employed is the chemiluminescent reaction of ozone with a rhodamine-B impregnated disk. Previously achieved sensitivities are required to be increased by a factor of about 20 to permit measurements at altitudes of 80 km. Sensitivity was increased by using a more sensitive photomultiplier tube, by increasing the gas velocity past the disk, by different disk preparation techniques, and by using reflective coatings in the disk chamber and on the uncoated side of the glass disk. Reflective coatings provided the largest sensitivity increase. The sum of all these changes was a sensitivity increased by an estimated factor of 70, more than sufficient to permit measurement of ambient ozone concentrations at altitudes of 80 km. Author

N74-10356*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATION OF REMOTE SENSING TO STUDY NEARSHORE CIRCULATION Annual Report
C. S. Welch and L. Haas Sep. 1973 85 p refs
(Grant NGL-47-022-005)
(NASA-CR-135827; AR-1) Avail: NTIS HC $6.75 CSCL 08C

Immediate use of drogued buoy tracking was made when the Virginia State Highway Department requested assistance in selecting the best route for a new bridge-tunnel complex across the James River at Newport News. The result was that the Highway Department acted and chose a preferred route from several alternatives. It was also observed that the drogues did not follow the channel as predicted by the James River hydraulic model. This permitted telling the Navy why it is that part of their channel always silts up. The Hampton Roads Sanitation District asked help locate the best route and position of an ocean sewer outfall. Biological activities are focused primarily on delineating biological interaction between the marsh and continental shelf waters on Virginia's Eastern Shore. Information derived is helpful in categorizing the relative biological value of different marsh areas so that meaningful use and management decisions can be made concerning their eventual disposition. Author

N74-10357*# South Dakota State Univ., Brookings. Remote Sensing Inst.
LAND CLASSIFICATION OF THE LAKE DAKOTA PLAIN IN SOUTH DAKOTA WITH REMOTE SENSING METHODS
Lawrence A. Benson Aug. 1973 23 p refs
(Grant NGL-42-003-007)
(NASA-CR-135841; SDSU-RSI-73-13) Avail: NTIS $3.25 CSCL 08B

Research has been conducted to investigate the use of remote sensing data for making land use decisions in the Lake Dakota Plain of South Dakota. These studies have verified the feasibility of detecting and mapping the principal soil limitations in the area from aerial photography. A method is presented, which integrates the detection of soil limitations into a land classification system based on photointerpretation. The technique requires photointerpretation at progressively larger scales and field checking of the photo-derived units. The photointerpretation begins with an analysis of ERTS-1 imagery at 1:1,000,000 scale to determine large physiographic and land use categories. High altitude imagery at 1:120,000 scale is used to subdivide the ERTS derived units based on physiographic aspects and pattern elements. Soils containing specific soil limitations are delineated from either low altitude photography or enlarged high altitude photography at 1:20,000 scale. Application of this technique to a detailed study area located in Spink County, South Dakota, resulted in a classification that should be of value to farmers, resource managers, and land planners alike. Author

N74-10358# Environmental Data Service, Asheville, N.C.
INTERNATIONAL DECADE OF OCEAN EXPLORATION, VOLUME 2 Progress Report, Jul. 1972 - Apr. 1973
Sep. 1973 70 p refs Sponsored by NSF
Avail: NTIS HC $5.50

Information, data inventories, and lists of scientific reports pertinent to IDOE are presented. The programs reported include: environmental forecasting, environmental, quality, and seabed assessment. National Marine Data Inventory summaries are also included. F.O.S.

N74-10359*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATMOSPHERIC CONSTITUENT MEASUREMENTS USING COMMERCIAL 747 AIRLINERS
Porter J. Perkins and Gregory M. Reck 1973 15 p refs Presented at 2d Joint Conf. on the Sensing of Environ. Pollutants, Washington, D. C., 10-12 Dec. 1973; sponsored by Instr. Soc. of Am.
(NASA-TM-X-71469; E-7770) Avail: NTIS HC $3.00 CSCL 04A

NASA is implementing a Global Atmospheric Monitoring Program to measure the temporal and spatial distribution of particulate and gaseous constituents related to aircraft engine emissions in the upper troposphere and lower stratosphere (6 to 12 Km). Several 747 aircraft operated by different airlines flying routes selected for maximum world coverage will be instrumented. An instrumentation system is being assembled and tested and is scheduled for operation in airline service in late 1974. Specialized instrumentation and an electronic control unit are required for automatic unattended operation on commercial airliners. An ambient air sampling system was developed to provide undisturbed outside air to the instruments in the pressurized aircraft cabin. Author

N74-10360*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF SLAR FOR MONITORING GREAT LAKES TOTAL ICE COVER
R. J. Jirberg, R. J. Schertler, R. T. Gedney, and H. Mark 1973 11 p refs Presented at the Interdisciplinary Symp. on Advan. Concepts and Tech. in the Study of Snow and Ice Resources, Monterey, Calif., 2-6 Dec. 1973
(NASA-TM-X-71473; E-7786) Avail: NTIS HC $3.00 CSCL 08L

A series of X-band SLAR images is presented showing the development and disintegration of the entire ice cover on Lake Erie during the winter of 1972-1973. Simultaneous ground truth observations and ERTS-1 photography establish accurate correlations of radar responses with ice conditions. The all-weather, broad areal mapping capability of SLAR is seen to be the means for obtaining the repeated coverage needed for winter navigation on the Great Lakes. Author

N74-10361*# Agricultural Research Service, Weslaco, Tex.
SPECTRAL SURVEY OF IRRIGATED REGION CORPS AND SOILS Annual Report, 1 Oct. 1970 - 30 Sep. 1971
30 Sep. 1971 262 p refs Original contains color illustrations
(NASA Order R-09-038-002)
(NASA-CR-125195) Avail: NTIS HC $15.25 CSCL 08G

The applications of remote sensing techniques to spectral surveys of irrigation, crops, and soils are reported. Topics discussed include: (1) canopy temperature as an indication of plant water stress, (2) temperature of soils and of crop canopies differing in water conditions, (3) ERTS project, (4) spectrum matching and pattern recognitation, (5) photographic procedures and interpretation, (6) interaction of light with plants, and (7) plant physiological and histological factors. F.O.S.

N74-10362# Joint Publications Research Service, Arlington, Va.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 310
15 Oct. 1973 91 p refs Transl. into ENGLISH from Russian articles
(JPRS-60276) Avail: NTIS HC $6.75

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N74-10363# Technische Universitaet, Brunswick (West Germany).
GEOMAGNETIC, GEOELECTRIC AND MAGNETOTELLURIC MEASUREMENTS DURING AN EXCURSION TO THE MOSENBERG AND TO THE MEERFELDER MAAR IN THE WESTERN EIFEL [GEOMAGNETISCHE, GEOELEKTRISCHE UND MAGNETOTELLURISCHE MESSUNGEN IM RAHMEN EINER EXKURSION ZUM MOSENBERG UND ZUM MEERFELDER MAAR IN DER WESTEIFEL]
Udo Hunsche 1973 84 p refs In GERMAN
Avail: NTIS HC $6.25

Anomalies magnetic measurements in the Mosenberg area confirm the volcanic structure and lead to the discovery of a strong lava stream. Magnetic observations on the Meerfelder Maar support the thesis that the two identations at the crater rim were formed by two vents in the inner crater wall, geological measurements indicate devonic rubble below 50 m depths. Magnetotelluric measurements for still hot lava sources were inconclusive. Transl. by G.G.

N74-10364# Finnish Meteorological Inst., Helsinki.
MONTHLY CLIMATOLOGICAL REPORT FOR FINLAND, MAY 1973 [KUUKAUSIKATSAUS SUOMEN ILMASTOON TOUKOKUU 1973 MAJ]
May 1973 12 p In FINNISH and SWEDISH
Avail: NTIS HC $3.00

Maps and tables are presented to depict the climatic conditions for Finland during the month of May 1973. Data are presented for maximum, minimum, and mean temperatures recorded at various ground stations. Various atmospheric parameters are compared for the period 1931 to 1960. Author

N74-10365*# General Research Corp., Arlington, Va.
IMAGE DATA PROCESSING SYSTEM REQUIREMENTS STUDY. VOLUME 1: ANALYSIS Final Technical Report, May - Aug. 1973
T. Honikman, E. McMahon, E. Miller, L. Pietrzak, and W. Yorsz
Oct. 1973 161 p ref
(Contract NAS5-21920)
(NASA-CR-132852; WGRC-73-3273-Vol-1; CR-1-417-Vol-1) Avail: NTIS HC $10.25 CSCL 14B

Digital image processing, image recorders, high-density digital data recorders, and data system element processing for use in an Earth Resources Survey image data processing system are studied. Loading to various ERS systems is also estimated by simulation. Author

N74-10366*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DYNAMICS OF MIDLATITUDE LIGHT ION TROUGH AND PLASMATAILS
A. J. Chen, J. M. Grebowsky, and H. A. Taylor, Jr. Aug. 1973 31 p refs Submitted for publication
(NASA-TM-X-70494; X-621-73-275) Avail: NTIS HC $3.75 CSCL 03B

Light ion trough measurements near midnight made by the RF ion mass spectrometer on OGO-4 operating in the high resolution mode in Feb. 1968 reveal the existence of irregular structure on the low latitude side of the midlatitude trough. Using two different relations between the equatorial convection electric field, assumed spatially invariant and directed from dawn to dusk, and Kp (one based on plasmapause measurements, the other on polar cap E field measurements) a model development was made of the outer plasmasphere. The model calculations produced multiple plasmatail extensions of the plasmasphere which compare favorably with the observed irregularities. Due to magnetic local time differences between the Northern and Southern Hemisphere along OGO's orbit, the time dependent irregularity structure observed is not symmetrical about the equator. The model development produces an outer plasmasphere boundary location which varies similarly to the observed minimum density point of the light ion trough. However the measurements are not extensive enough to yield conclusive proof that one of the electric field models is better than the other. Author

N74-10367# Coast Guard, Washington, D.C. Oceanographic Unit.
LIGHT VESSEL/LIGHT STATION OCEANOGRAPHIC OBSERVATIONS: EAST COAST OF THE UNITED STATES, JANUARY - DECEMBER 1971
R. E. Kangas Jul. 1973 129 p refs
(CG-373-59) Avail: NTIS HC $8.50

Daily water temperatures and salinities for 1971 from 11 locations along the Atlantic coast are presented and discussed. Author

N74-10368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SEARCH FOR GLOBAL AND SEASONAL VARIATION OF METHANE FROM NIMBUS 4 IRIS MEASUREMENTS
C. Prabhakara, G. Dalu, and V. G. Kunde Oct. 1973 29 p refs Submitted for publication
(NASA-TM-X-70497; X-651-73-319) Avail: NTIS HC $3.50 CSCL 04A

The Nimbus 4 infrared interferometer spectrometer (IRIS) measurements in the region around wave number 1304 show absorption due to methane in the earth's atmosphere. From the laboratory measurements of the absorption coefficient and a selected vertical distribution corresponding to 1.13 atm cm of methane, a theoretical model for the transmittance at wave number 1304 is developed. The weighting function deduced from this model shows a maximum around 300 mb. Some weak absorption due to nitrous oxide in the atmosphere has been taken into account. The vertical temperature profile, derived from the 15 micron CO2 band in the IRIS spectrum, together with the methane weighting function have been used in a consistent way to compute the upwelling intensity at wave number 1304. The brightness temperature corresponding to the IRIS observed radiance at wave number 1304 has been compared with the brightness temperature deduced from the calculated upwelling intensity from 80 deg North to 80 deg South and for different periods of the year. This comparison shows that the two brightness temperatures agree with one another to within the accuracy of measurements about 2 K. From this result it was found that global or seasonal variability of methane is less than + or - 0.25 atm cm. Author

N74-10369# National Environmental Satellite Service, Washington, D.C.
EFFECTS OF AEROSOLS ON THE DETERMINATION OF THE TEMPERATURE OF THE EARTH'S SURFACE FROM RADIANCE MEASUREMENTS AT 11.2 MICRONS
H. Jacobowitz and K. L. Coulson (Calif. Univ., Davis) Sep. 1973 21 p refs
(NOAA-TR-NESS-66) Avail: SOD HC $0.55

The influence of atmospheric aerosols on outgoing terrestrial radiation in the window region at 11.2 microns is estimated by atmospheric modelling. Nine different particle size distributions,

3 vertical aerosol concentration profiles, and 5 vertical temperature profiles are considered for a total of 135 atmospheric models. For each model, the upward radiant intensity was computed for every 0.2 km from the surface to 20 km. From these values, equivalent black body temperatures were determined as a function of height, and the error in the derived surface temperature due to aerosols was computed. Results show that absorption by aerosols is dominant over emission, making the deduced surface temperature lower than actual, except in the subarctic winter. Errors were generally less than 2 K except under extreme conditions. Author

N74-10370*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTROSTATIC VELOCITY-SPACE INSTABILITIES STIMULATED NEAR THE HARMONICS OF THE ELECTRON CYCLOTRON FREQUENCY IN THE IONOSPHERE
Robert F. Benson Oct. 1973 23 p refs Submitted for publication
(NASA-TM-X-70502; X-621-73-188) Avail: NTIS HC $3.25 CSCL 04A

Data are presented on observations made in the ionospheric plasma that provide evidence for the stimulation of Harris type instabilities at nf sub H in a single electron transition. An illustration is also given of the change in shape of the dispersion curve for a given nf sub H as the upper hybrid frequency crosses the nf sub H value. It was concluded that the instability can exist near nf sub H only when the hybrid frequency > nf sub H. Author

N74-10371*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETAILED GEOID COMPUTATIONS FOR GEOS-C ALTIMETER EXPERIMENT AREAS
James G. Marsh and Samir Vincent Oct. 1973 29 p refs Submitted for publication
(NASA-TM-X-70503; X-592-73-303) Avail: NTIS HC $3.50 CSCL 08E

The GEOS-C spacecraft is scheduled to carry onboard a radar altimeter for the purpose of measuring the geoid undulations in oceanic areas. An independently derived geoid map will provide a valuable complement to these experiments. A detailed gravimetric geoid is presented for the Atlantic and northeast Pacific Ocean areas based upon a combination of the Goddard Space Flight Center GEM-6 earth model and surface 1 deg x 1 deg gravity data. As part of this work a number of satellite derived gravity models were evaluated to establish the model which best represented the long wave length features of the geoid in the above mentioned area. Comparisons of the detailed geoid with the astrogeodetic data provided by the National Ocean Survey and dynamically derived tracking station heights indicate that the accuracy of this combined geoid is on the order of 2 meters or better where data was dense and 5 to 7 meters where data was less dense. Author

N74-10372# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA Data Summary, Apr. - Jun. 1973
G. Gustafsson, ed 1973 64 p Sponsored by ESRO
(Rept-73/4-6) Avail: NTIS HC $5.25

Ground measurements conducted at the Kiruna Geophysical Observatory are presented. The data obtained relate to polar upper atmospheric conditions and include measurements of: geomagnetism, optical aurora, ionospheric ionization, radio wave propagation, and cosmic radiation. D.L.G.

N74-10373*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE MAPS OF THE POLAR ICE OF THE EARTH
P. Gloersen, T. T. Wilheit, T. C. Chang, W. Nordberg, and W. J. Campbell (USGS) Aug. 1973 40 p refs Submitted for publication Original contains color illustrations
(NASA-TM-X-70493; X-652-73-269) Avail: NTIS HC $4.00 CSCL 08L

Synoptic views of the entire polar regions of earth were obtained free of the usual persistent cloud cover using a scanning microwave radiometer operating at a wavelength of 1.55 cm on board the Nimbus-5 satellite. Three different views at each pole are presented utilizing data obtained at approximately one-month intervals during the winter of 1972-1973. The major discoveries resulting from an analysis of these data are as follows: (1) Large discrepancies exist between the climatic norm ice cover depicted in various atlases and the actual extent of the canopies. (2) The distribution of multiyear ice in the north polar region is markedly different from that predicted by existing ice dynamics models. (3) Irregularities in the edge of the Antarctic sea ice pack occur that have neither been observed previously nor anticipated. (4) The brightness temperatures of the Greenland and Antarctica glaciers show interesting contours probably related to the ice and snow morphologic structure. Author

N74-10374*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL DETAILED GRAVIMETRIC GEOID
Samir Vincent (Computer Sciences Corp., Falls Church, Va.) and James G. Marsh Sep. 1973 44 p refs Submitted for publication
(NASA-TM-X-70492; X-592-73-266) Avail: NTIS HC $4.25 CSCL 08E

A global detailed gravimetric geoid has been computed by combining the Goddard Space Flight Center GEM-4 gravity model derived from satellite and surface gravity data and surface 1 deg-by-1 deg mean free air gravity anomaly data. The accuracy of the geoid is + or - 2 meters on continents, 5 to 7 meters in areas where surface gravity data are sparse, and 10 to 15 meters in areas where no surface gravity data are available. Comparisons have been made with the astrogeodetic data provided by Rice (United States), Bomford (Europe), and Mather (Australia). Comparisons have also been carried out with geoid heights derived from satellite solutions for geocentric station coordinates in North America, the Caribbean, Europe, and Australia. Author

N74-10375# Instituto Geografico y Catastral, Madrid (Spain).
A STUDY, BY MEANS OF HARMONIC ANALYSIS, OF THE DAILY VARIATION IN THE OBSERATIONS OF THE GEOMAGNETIC FIELD FOR THE IBERIAN PENINSULA DURING A SOLAR CYCLE [ESTUDIO MEDIANTE EL ANALISIS ARMONICO DE LA VARIACION DIARIA DEL CAMPO GEOMAGNETICO EN LOS OBSERVATORIOS DE LA PENINSULA IBERICA DORANTE UN CICLO SOLAR]
Fernando AranazydelRio 1973 146 p refs In SPANISH
Avail: NTIS HC $9.50

Hourly geomagnetic data for Spain, corresponding to the solar cycle of 11 years was analyzed. The period 1958 to 1968 was selected, and included data from the observatories at Toledo, Longro, Almeria, and San Fernando y Coimbra. An equation for defining daily variations, and for predicting solar activity is derived. Short time anomalies were observed, and a series of long term anomalies are compared with results of other researchers. The computer program is included for analyzing declination, vertical and horizontal components, regression, correlation, and amplitude as a function of latitude. Transl. by F.O.S.

N74-10376# Weapons Research Establishment, Salisbury (Australia).
COMPLETE LISTING OF UPDATED RESULTS FROM FALLING SPHERE EXPERIMENTS CONDUCTED IN AUSTRALIA, MARCH 1962 TO JUNE 1972
P. H. O. Pearson and S. G. Johnson Jun. 1973 135 p refs
(WRE-TN-799) Avail: NTIS HC $8.75

A total of 70 successful experiments have been conducted in Australia during the past ten years to measure basic atmospheric parameters by means of the falling sphere technique. An inflatable sphere of 2m diameter was used to obtain the results which have been reported previously. Revised information on the drag of spheres was incorporated to update the original results. All data are presented in tabular form at kilometer height intervals ranging between 30 and 100km altitude. Author

N74-10377# Servicio Meteorologico Nacional, Buenos Aires (Argentina).
GEOMAGNETIC ANNUAL OF PILAR GEOPHYSICAL OBSERVATORY FOR 1970 [ANALES GEOMAGNETICOS OBSERVATORIO GEOFISICO PILAR 1970]
1972 43 p In SPANISH
(Ser-B-25) Avail: NTIS HC $4.25

The hourly measurements of declination, horizontal component, vertical component, D and Q components at Pilar are presented for 1070. Transl. by F.O.S.

N74-10378# Servicio Meteorologico Nacional, Buenos Aires (Argentina).
GEOMAGNETIC ANNUAL OF LAQUIACA GEOPHYSICAL OBSERVATORY FOR 1970 [ANALES GEOMAGNETICOS, OBSERVATORIO GEOFISICOLAQUIACA, 1970]
1972 42 p In SPANISH
(Ser-B-26) Avail: NTIS HC $4.25

The hourly measurements of declination, horizontal component, vertical component, and D an Q components at LaQuiaca are presented for 1970. Transl. by F.O.S.

N74-10379*# Stanford Univ., Calif. Inst. for Plasma Research.
GENERATION OF ALFVEN WAVES IN THE MAGNETOSPHERE BY PARAMETRIC INTERACTION BETWEEN WHISTLERS
K. J. Harker, F. W. Crawford, and A. C. Fraser-Smith Oct. 1973 33 p refs
(Grant NGL-05-020-176; Contract N00014-67-A-0112-0066; ARPA Order 1733)
(NASA-CR-135988; SU-IPR-535) Avail: NTIS Hc $3.75 CSCL 03B

A theory is developed for the generation of Alfven waves by the mixing of whistler waves. Calculations are carried out for interaction in the magnetosphere where the whistlers fall in the VLF frequency range, and the Alfven wave in the ULF (1-5)He) range. Typical amplitudes of 2-5 microns for the Alfven wave are calculated, and it is shown that these values might be increased by one order of magnitude through suitable variation of the experimental parameters. The study thereby develops a possible explanation for naturally occurring Pc 1 micropulsations, and demonstrates the feasibility of artificial generation of such micropulsations by ground-launched whistlers. Author

N74-10380*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
INVESTIGATION OF TECHNIQUES FOR CORRECTION ERTS DATA FOR SOLAR AND ATMOSPHERIC EFFECTS Interim Report, Feb - Jul. 1973
Robert H. Rogers Aug. 1973 53 p refs
(Contract NAS5-21863)
(NASA-CR-132860) Avail: NTIS HC $4.75 CSCL 05B

Significant findings during this report period are: (1) The feasibility of using techniques for obtaining and using atmospheric parameter to transform ERTS data into absolute target reflectance was demonstrated. (2) Ground-truth instrumentation must have a dynamic range of 100,000 for obtaining the full set of atmospheric parameters encountered in the field. (3) Atmospheric transmittance for January through May 1973 varied from 13 to 18 percent in the ERTS bands. (4) Energy scattered to the spacecraft from the atmosphere for the March overflight was equivalent to that produced by a target having a reflectance of 11% in band 4, 5% in band 5, 3% in band 6, and 1% in band 7. (5) This atmospheric radiance varies as a function of sun zenith angle (scatter angle) and is predicted to change by 30% for sun angles at the latitude of the Michigan test site. (6) If not removed from spacecraft measurements before computing reflectance of surface targets, this radiance is a major source of error. Author

N74-10381*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE SIGNATURES OF SNOW AND FRESH WATER ICE
T. Schmugge, T. T. Wilheit, P. Gloersen, M. F. Meier (USGS, Tacoma, Wash.), D. Frank (USGS, Tacoma, Wash.), and I. Dirmhirn (Utah State Univ.) Nov. 1973 15 p refs Presented at the Interdisciplinary Symp. on Advanced Concepts and Tech. in the Study of Snow and Ice Resources Original contains color illustrations
(NASA-TM-X-70515; X-652-73-335) Avail: NTIS HC $3.00 CSCL 08L

During March of 1971, the NASA Convair 990 Airborne Observatory carrying microwave radiometers in the wavelength range 0.8 to 21 cm was flown over dry snow with different substrata: Lake ice at Bear Lake in Utah; wet soil in the Yampa River Valley near Steamboat Springs, Colorado; and glacier ice, firm and wet snow on the South Cascade Glacier in Washington. The data presented indicate that the transparency of the snow cover is a function of wavelength. False-color images of microwave brightness temperatures obtained from a scanning radiometer operating at a wavelength of 1.55 cm demonstrate the capability of scanning radiometers for mapping snowfields. Author

N74-10382*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLUMES IN THE MANTLE
M. A. Khan Nov. 1973 27 p refs
(NASA-TM-X-70514; X-592-73-334) Avail: NTIS HC $3.50 CSCL 08E

Free air and isostatic gravity anomalies for the purposes of geophysical interpretation are presented. Evidence for the existence of hotspots in the mantle is reviewed. The proposed locations of these hotspots are not always associated with positive gravity anomalies. Theoretical analysis based on simplified flow models for the plumes indicates that unless the frictional viscosities are several orders of magnitude smaller than the present estimates of mantle viscosity or alternately, the vertical flows are reduced by about two orders of magnitude, the plume flow will generate implausibly high temperatures. Author

N74-10383# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
MEASUREMENTS OF SHORT WAVE RADIATION FLUXES IN THE FREE ATMOSPHERE WITH 4-CHANNEL RADIOSONDE AND AUTOMATIC PROCESSING OF THE RESULTS
Heinz Queck and Manfred Lehner Porz, West Ger. 7 Mar. 1973 57 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-73-13) Avail: NTIS HC $5.00; DFVLR, Porz, West Ger. 15,70 DM

A method is described for evaluation of radiation data obtained with special radiosondes. The basic equations for turbidity estimations are defined. The computer program for the data evaluation is described. The first part of the program determines the reference frequencies and the corresponding reference levels. The resulting pressure-time-coordination is transformed into a pressure-height-coordination with the aid of the corresponding routine radiosonde ascent. After the separation of the measuring and reference frequencies, the radiation values are computed from the remaining data sets. The computed values are illustrated by an example. Author (ESRO)

N74-10384# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
PRINCIPLES OF A RAMAN-LIDAR SYSTEM [GRUNDLAGEN FUER EIN RAMAN-LIDAR-SYSTEM]
Christian Werner Porz, West Ger. 19 Apr. 1973 32 p refs In GERMAN; ENGLISH summary
(DLR-Mitt-73-19) Avail: NTIS HC $3.75; DFVLR, Porz, West Ger. 11,20 DM

The system parameters were calculated for a Raman lidar system to determine the water vapor/nitrogen mixing ratio in the atmosphere. Extension calculations, relating to standard distributions of aerosol, nitrogen and water vapor and taking into account background radiation, lead to a system allowing the mixing ratio to be measured continuously over some kilometers in altitude. The extinction of the laser beam has not been accounted for. As this influence is small for the case of simultaneous measurement and formation of the ratio, the mixing ratio can be determined. Absolute measurements of temperature or moisture were found to be erroneous. ESRO

N74-10385# Plessey Co., Ltd., Havant (England). Electronics Research Lab.
MULTISPECTRAL SCANNING SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH RESOURCE SURVEYS: VOLUME 6: SUMMARY
Jun. 1973 215 p
(Contract ESTEC-1673/72-EL)
(ERL/R-248; ESRO-CR(P)-236) Avail: NTIS HC $12.75

This volume summarizes the first four technical volumes of the series together with the applications recommendations. Various processes are considered affecting the interaction of radiation and matter that give rise to useful information about the surface of the earth, the methods of sensing this information, the properties of specific materials of interest, the processing of the data acquired by an MSS system, and the applications to which such a system may be applied. The report is structured so that, in the main, direct reference can be made back to the previous volumes of the series for more detailed information. For vol. 1, see N73-22403; vol. 2, N73-22404; vol 3, N73-30356; vol. 4, N73-28450; vol 5, N73-32301; and vol. n N73-32229
Author (ESRO)

N74-10386# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, May 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, MAI 1973]
May 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75
Results of ionospheric and cosmic ray (neutron component) observations at Dourbes, (Belgium) are tabulated for May 1973.
ESRO

N74-10387# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jun. 1973 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JUIN 1973]
Jun. 1973 31 p In FRENCH and DUTCH
Avail: NTIS HC $3.75
Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for June 1973.
ESRO

N74-10388# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Mar. 1973 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, MARS 1973]
Mar. 1973 26 p In FRENCH and DUTCH
Avail: NTIS HC $3.50
Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during March 1973 are presented.
ESRO

N74-10389# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, Apr. 1973 [OBSERVATIONS GEOPHYSIQUES BULLETIN MENSUEL, AVRIL 1973]
Apr. 1973 26 p In DUTCH and FRENCH
Avail: NTIS HC $3.50
Geophysical data obtained at Dourbes (Belgium) relating to geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity, and cosmic rays during April 1973 are presented.
ESRO

N74-10390# Institut Royal Meteorologique de Belgique, Brussels.
SPECTRAL ANALYSIS OF GEOMAGNETIC DATA FROM ONE STATION (DOURBES 1960-1970)
A. DeVuyst and F. DeMeyer 1973 27 p refs
(Publ-Ser-A-80) Avail: NTIS HC $3.50
Spectral analysis of geomagnetic data on magnetic field elements energy in the micropulsation interval, the daily variation interval, the magnetic disturbance band, the 27-day band, the semi-annual, annual, and solar cycle band was carried out. Spectral analysis procedures are discussed. They include description of the data, digitization of the continuous record, filtering of data, computation of the autocovariance estimation of power spectrum, and use of the periodograms. It was concluded that power spectra give a better picture of the physical mechanisms, a closer look at local electrical conductivity anomalies and a continuous background.
ESRO

N74-10391# Ecole Polytechnique Federale de Lausanne (Switzerland). Centre de Recherches en Physique des Plasmas.
ENERGY: COMPILED BIBLIOGRAPHY AND TABLES OF WORLD RESOURCES, CONSUMPTION, AND WASTES [ENERGIE: COMPILATION BIBLIOGRAPHIQUE ET TABULATION DES RESSOURCES, DE LA CONSOMMATION ET DES DECHETS DANS LE MONDE]
M. Roux Jul. 1973 66 p refs In FRENCH; ENGLISH summary
Sponsored by Fonds Natl. Suisse de la Rech. Sci.
(LRP-63/73) Avail: NTIS HC $5.50
The available resources of fossil and nuclear fuels, as well as those of solar energy, hydroelectric power and others, are reviewed and compared to global consumption of energy. The per capita and global consumption, together with its growth rate, are presented with respect to primary energy sources and/or main sectors of use. Attention is focused on the energy required by electrical power generation, and estimates up to 2000 are given. Chemical and radioactive nuclear wastes resulting from either energy consumption or electrical power generation are tabulated and scaled to the energy consumption. Wastes from the nuclear economy are estimated up to 2000. The relative biological hazards pertaining to radioactive inventories and fission reactor wastes are compared to those of a reference reactor.
ESRO

N74-10392# Naval Research Lab., Washington, D.C.
OPTIMIZATION OF PROBE EXCITATION FOR A TWO-PROBE MEASUREMENT OF THE REFRACTIVE-INDEX STRUCTURE FUNCTION CONSTANT OF THE ATMOSPHERE Final Report
Robert W. Harris 31 Jul. 1973 13 p
(AD-766088; NRL-7587) Avail: NTIS CSCL 04/1
The study considers the tradeoffs involved in selecting the excitation power for a pair of fine-wire resistance thermal probes for the measurement of the atmospheric refractive-index structure function constant C(N). It is shown that the choice is critical if valid measurements are to be made down to 10 to the minus 8th power/m to the 1/3 power. The optimum probe excitation found is approximately one microwatt, which is consistent with earlier NRL practice but inconsistent with generally accepted values used elsewhere which range upwards from 10 microwatts.
Author (GRA)

N74-10393# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EMPIRICAL MODEL OF INERT COMPOSITION OF THE ATMOSPHERE AT ALTITUDES OF 130-200 KM
A. D. Danilov and N. A. Shashilova 16 Aug. 1973 17 p refs Transl. into ENGLISH from Tr. Inst. Prikl. Geofiz. (Leningrad), no. 16, 1971 p 57-66
(AD-766039; FTD-HT-23-800-73) Avail: NTIS CSCL 04/1
Variations in the inert composition of the upper atmosphere at altitudes of 130-200 km is studied with respect to altitude, local time, and solar activity.
GRA

N74-10394# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENT OF RADIATION OF THE ATMOSPHERE IN THE 8-12 MICRON BAND
A. G. Gorelik and S. F. Kalachinskii 10 Aug. 1973 18 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 103, 1972 p 82-93
(AF Proj. 3005)
(AD-765990; FTD-MT-24-701-73) Avail: NTIS CSCL 04/1
The development of the methods of measurement of atmospheric parameters with the aid of the equipment which works in the IR region of the spectrum (8-12 micrometers) imperatively requires obtaining reliable experimental data on the propagation of infrared radiation in the real atmosphere. Attention is directed to the creation of the measuring radiometer having high lasting stability and the ability to carry out calibration directly during measurement.
GRA

N74-10395# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.

HEAVY ION INVESTIGATIONS Final Report, period ending 30 Jul. 1973
Richard D. Sharp and Richard G. Johnson 30 Jul. 1973 41 p refs
(Contract N00014-73-C-0165; ARPA Order 2246; NR Proj. 087-178)
(AD-765744; LMSC-D352865) Avail: NTIS CSCL 04/1

Heavy ions with energies between 1 and 9 keV have frequently been detected with an energetic ion mass spectrometer on the satellite 1969-25B during the period March 1969 to August 1970. Their identification as 0- ions of ionspheric origin has been inferred from a comparison with the more complete mass measurements with an improved spectrometer on the satellite 1971-089A, and from considerations of ionospheric and solar wind abundance ratios. Data from nine magnetic storms have been analyzed, and the peak responses occurred at L values between 3.4 and 6.4, and at magnetic local times between 21.8 and 4.5 hours. A maximum flux of approximately 0.1 erg/sq. cm-sec-sterad was observed during the 23-24 March 1969 storm. Author (GRA)

N74-10396*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
ANGULAR DISTRIBUTION AND ALTITUDE DEPENDENCE OF ATMOSPHERIC NEUTRONS FROM 10 TO 100 MeV
Alan M. Preszler, George M. Simnett, and R. Stephen White 27 Jul. 1973 34 p refs
(Grant NGR-05-008-002; Contracts N00014-69-A-0200-5004; N00014-69-A-020-5001)
(NASA-CR-135825; AD-765906; IGPP-UCR-73-25) Avail: NTIS HC $3.74 CSCL 04/1

The altitude dependence of atmospheric neutrons from ground level to 5 g/sq cm of residual atmosphere at neutron energies of 10 to 100 MeV is reported. Ground level measurements were taken at Cape Girardeau, Missouri, on September 18, 1972. The other measurements were made during ascent and float on launch from Palestine, Texas on September 26, 1971. The intensity of both the downward and upward moving neutrons is maximum at about 100 g/sq cm of residual atmosphere. Neutron angular distributions are reported from 20 degrees to 80 degrees and 100 degrees to 160 degrees for 10 to MeV neutrons. Omnidirectional fluxes at altitudes at 5, 50, 100, and 200 g/sq cm residual atmosphere are in good agreement with recent theoretical calculations of Armstrong et al. in the three energy intervals of 10-30, 30-50, and 50-100 MeV. Author (GRA)

N74-10397# Texas A&M Univ., College Station. Dept. of Oceanography.
STRUCTURE OF THE WEST FLORIDA PLATFORM, GULF OF MEXICO
Thomas E. Pyle (Univ. of South Fla., St. Petersburg) and John W. Antoine Jun. 1973 198 p refs
(Contract N00014-68-A-0308-0002)
(AD-764615; A/M-REF-73-7-T) Avail: NTIS CSCL 08/7

The purpose of this study was to investigate the structure of the Florida Escarpment and western Straits of Florida using continuous seismic reflection profiles and magnetic field measurements. Results are analyzed within the framework of deep-sea coring and dredging data, seismic refraction and gravity surveys, and information from deep wells on land. The study area lies in the eastern Gulf of Mexico, south of the transition from thick clastic sequences to platform carbonates in northern and central Florida. Lying just north of the Antillean island of Cuba, the region includes part of the boundary between the Gulf and Caribbean basins. GRA

N74-10398# Army Foreign Science and Technology Center, Charlottesville, Va.
CHARACTERISITCS OF FOREIGN PHOTO MAPS
L. M. Goldman 3 Jan. 1973 11 p refs Transl. into ENGLISH from Geodez. Kartograf. (Moscow), no. 12, 1969 p 32-36
(AD-765899; FSTC-HT-23-970-72) Avail: NTIS CSCL 08/2

A literature review was conducted of articles published outside of the U.S.S.R. dealing with photomaps. The basic variations of photomaps are listed along with their advantages and shortcomings. The status of photomap technology in various countries is summarized. D.L.G.

N74-10399# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A NEW MEAN REFERENCE ATMOSPHERE FOR 25 TO 500 km
K. S. W. Champion and R. A. Schweinfurth 2 Oct. 1972 28 p refs
(AF Proj. 6690)
(AD-757483; AFCRL-72-0579; AFCRL-AFSIG-247) Avail: NTIS CSCL 04/1

The model was prepared as part of the activities of the Committee on Space Research (COSPAR) panel on new reference atmospheres. It will be published as The Mean COSPAR International Reference Atmosphere 1972. The reference atmospheres aid in the design of aircraft, missiles and satellites. The Mean Atmosphere, provided for the altitude range 25 to 500 km, contains tables of temperature, density, and pressure for the whole range. Composition (major constituents and some minor constituents) is given for the range 75 to 500 km. The model represents mean annual and solar cycle conditions for latitudes near 30 degrees. Author (GRA)

N74-10400# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Electrical Processes Branch.
MAPPING OF HIGH LATITUDE IONOSPHERIC CHARACTERISTICS Interim Report
Rita Sagalyn, Susan Bredesen, and Peter Wildman 18 Jul. 1973 30 p refs
(AF Proj. 8617)
(AD-766417; AFCRL-TR-73-0416) Avail: NTIS CSCL 04/1

Local time and seasonal characteristics of the high latitude ionization irregularity regions have been determined from the examination of the ISIS-1 Satellite thermal charged particle data during the first year of satellite operation, Feb. 1969 to Feb. 1970. ISIS-1, launched Jan. 30, 1969 into a polar orbit, inclination 88.5 degrees, has an apogee of 3526 km and perigee of 525 km. Frequency of occurrence calculations of the equatorial and polar boundaries of the irregularity zones are based primarily on Northern Hemisphere data. The amplitude and width of the thermal charged particle trough, for electrons and ions located at the equatorial edge of the irregularity zone, are evaluated as a function of local time using both Southern and Northern Hemisphere data. Results from over 3000 satellite orbits are examined. Although the electrostatic probe results were obtained in the topside ionosphere, extensive comparisons with simultaneous topside sounder measurements on board ISIS-1 show that down to the minimum scale size which can be observed with the sounder, approximately 18 km, the irregularities map down to the peak of the F region. These results thus represent a statistical mapping of ionospheric characteristics at the peak of the F layer of the ionosphere. Author (GRA)

N74-10401# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
GEOMAGNETIC FIELD MODELS FOR RAY TRACING Environmental Research Papers
Ming S. Wong, Krishna-Sastry Vanguri (Arcon Corp., Wakefield, Mass.), and Manfred P. Friedman 8 May 1973 51 p refs
(AF Proj. 5631)
(AD-766241; AFCRL-TR-73-0294; AFCRL-ERP-446) Avail: NTIS CSCL 04/1

An accurate geomagnetic-field model, consisting of the dipole plus seven higher-order harmonics in dipolar coordinates, is incorporated into a computer program for three-dimensional ray tracing. Three options of using magnetic-field models are provided: (1) using accurate field in computing both the ray trajectory and the propagation-aspect angle between the geomagnetic-field vector and the wave-normal vector associated with each point along the ray; (2) using the dipole field for computing rays but using the accurate field for computing aspect angles; (3) using the dipole field for both the rays and aspect angles. Comparisons are made among the results computed, using the three options, in the HF band for a nighttime polar ionosphere and for a noontime equatorial ionosphere. Typical differences of few to ten degrees occur in the aspect angle, for aspect angles near 90 degrees -- the value under which geomagnetic-field-aligned ionization, if present, would give rise to maximum backscatter of HF waves and thus cause clutter in Over-the-Horizon radars. Author (GRA)

N74-10402# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AN EMPIRICAL MODEL OF THE POLAR IONOSPHERE Air Force Surveys in Geophysics
Terence J. Elkins, ed. 23 May 1973 96 p refs
(AF Proj. 5631)
(AD-766240; AFCRL-TR-73-0331; AFCRL-AFSIG-267) Avail: NTIS CSCL 04/1

Four separate articles are collected which deal with the construction of empirical models of the polar ionosphere. The particular emphasis in these articles is towards the radio propagation application of the models. Numerical models of the vertical electron density profiles on the topside and bottomside of the F-region are developed, and a model for sporadic-E is included. Special attention is devoted to features which are characteristic of the polar ionosphere-auroral effects, the trough, and magnetospheric cleft regions. The models are constructed specifically for convenience in computer programming, and in fact, all aspects of the models contained in this report are available in the form of FORTRAN computer programs. Author (GRA)

N74-10403# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
FACTORS INVOLVED IN OPTICAL PROGRAMS FOR THE POLAR CAP Environmental Research Papers
B. S. Dandekar 29 Dec. 1972 33 p refs
(AF Proj. 7661)
(AD-766246; AFCRL-TR-72-0746; AFCRL-ERP-428) Avail: NTIS CSCL 04/1

Polar cap optical phenomena is summarized to show that these form a distinct category. Various aspects of the problem such as logistic difficulties, a working definition of the polar cap, the present status of the knowledge of polar optical phenomena, the type of information obtained from the study, and the instrumentation presently available, are discussed. These factors are evaluated to derive a best possible, workable optical program for the polar cap studies. Author (GRA)

N74-10404# Kentucky Univ., Lexington. Dept. of Civil Engineering.
EFFECTS OF STRAIN AMPLITUDE ON THE SHEAR MODULUS OF SOILS Technical Report, 1 Oct. 1971 - 1 Nov. 1972
Bobby O. Hardin Mar. 1973 77 p refs
(Contract F29601-72-C-0027; AF Proj. 683M)
(AD-757516; UKY-TR63-72-CE23; AFWL-TR-72-201) Avail: NTIS CSCL 08/13

One hundred twenty-three simple shear tests of 24 different soils were conducted. Most were constant-amplitude repeated load tests. A few of the tests involved mixed amplitudes of loading with rest periods between loads. Based on the results, a practical procedure for reducing the shear modulus of soils with increasing strain amplitude was developed. It was shown that for a wide variety of soil types and conditions the procedure gives reasonably accurate results compared to values measured in the laboratory. The study of mixed amplitudes and rest periods indicated that the procedure can be applied to mixed traffic conditions. Author (GRA)

N74-10405# Goodyear Aerospace Corp., Litchfield Park, Ariz.
BASE PLANT CORRELATOR Final Technical Report, 8 May 1971 - 21 Dec. 1972
Roy H. Ogburn 9 Feb. 1973 94 p refs
(Contract DAAK02-71-C-0113)
(AD-759512; GERA-1900; ETL-CR-73-3) Avail: NTIS CSCL 08/2

The Base Plant Correlator provides the capability of processing the phase histories of side-looking interferometric coherent radars. The coherent optical system of the Base Plant Correlator provides the capability of processing a single channel of radar data in the tilted plane mode, or simultaneously processing one high-resolution channel and the corresponding interferometric channel in the dual-channel mode. Correlator performance during the final acceptance tests are described. (Author Modified Abstract) GRA

N74-10406# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF ACCURACY OF INDIVIDUAL PHOTO-TRIANGULATION PROCESS BY METHODS OF MATHEMATICAL STATISTICS
V. A. Polyakova 1 Nov. 1972 9 p refs Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 6, 1971 p 52-56
(AD-765967; FSTC-HT-23-917-72) Avail: NTIS CSCL 08/2

Statistics developed from large samples of photographs of varying quality are used to determine the distribution of measurement errors and errors in coordinating adjacent photographs. Tables are given for the case of aerial photographs at a scale of 1:25,000. Author (GRA)

N74-10407# Washington Univ., Seattle.
MINOR GASES IN THE EARTH'S ATMOSPHERE: A REVIEW AND BIBLIOGRAPHY OF THEIR SPECTRA Final Report
Nels Laulainen Sep. 1972 102 p refs
(Grant NSF GP-29339; Proj. ASTRA)
(PB-222244/6; UWASH-ASTRA-72-18) Avail: NTIS HC $7.25 CSCL 04A

A survey of the minor atmosphere gases, including H2O, CO2, HC4, O3, CO, N2O, SO2, H2S and NH3 is given. Special attention is given to their detection and identification by optical spectroscopic techniques. The abundance, distribution (both vertical and geographical), influence on either the global and balance or chemical reactions in the atmosphere, lifetime, and any time variation is discussed individually for each constituent. The survey concludes with a brief discussion of areas of atmosphere research, which need continued or increased support. An extensive cross-indexed bibliography of the minor atmospheric gases and their spectra (mainly restricted to the infrared) is also given. The bibliography is sub-divided into a number of reasonably percise and self-explanatory headings. Author (GRA)

N74-10408# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SETTLING OF AEROSOL, INTRODUCED INTO THE ATMOSPHERE AS A VERTICAL TURBULENCE STREAM
V. F. Dunskii 23 Apr. 1973 17 p refs Transl. into ENGLISH from Vopr. Atmosfernoi Diffuzii Zagryazneniya Vozdukha (USSR), no. 207, 1968 p 215-222
(AD-759858; FTD-HT-23-162-73) Avail: NTIS CSCL 04/1

The application of the semiempirical theory for turbulent streams to the study of convective diffusion of an aerosol from a point on a linear source is examined. Author

N74-10409# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MAGNETOSPHERIC CONVECTION AT IONOSPHERIC HEIGHTS Environmental Research Papers
Michael Mendillo 12 Jun. 1973 23 p refs
(AF Proj. 4643)
(AD-766426; AFCRL-TR-73-0358; AFCRL-ERP-447) Avail: NTIS CSCL 04/1

A simplified approach is used to obtain analytical expressions for the ionospheric drifts in three dimensions which would result from a spatially uniform and temporally constant magnetospheric dawn-dusk electric field. The resultant vector product E x B convection velocities of F-region heights agree in general character with the few measurements available from Thomson scatter drift experiments carried out during geomagnetically disturbed conditions. Author (GRA)

N74-10410# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
AN INVESTIGATION OF SOLAR ECLIPSE EFFECT ON THE SUBPOLAR STRATOSPHERE
J. S. Randhawa Sep. 1973 23 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-766696; ECOM-5507) Avail: NTIS CSCL 04/1

An experiment to study the effect of partial solar eclipse on the stratosphere was performed at Poker Flat, Alaska (65 degrees 07 minutes N, 147 degrees 28 minutes W), where a partial solar eclipse occurred on July 1972. Chemiluminescent ozonesondes were depolyed by Arcas Meteorological rockets to an altitude of 50-55 km. After ejection the sensors descended via radar reflective parachutes and transmitted alternately ozone content and ambient temperature. Soundings were made during the week of the eclipse as well as during and immediately before

and after it. Results obtained indicate that there was no significant effect due to eclipse on ozone concentration, temperature, and winds in the upper stratosphere of the subpolar region.
Author (GRA)

N74-10411# Brown Univ., Providence, R.I. Dept. of Geological Sciences.
DYNAMIC OF NATURAL CLIMATIC CHANGE Semiannual Technical Report, 15 Dec. 1972 - 14 Aug. 1973
John Imbrie, R. K. Matthews, and Thompson Webb, Jr. 1 Sep. 1973 29 p refs
(Contract F44620-73-C-0021; ARPA Order 2299)
(AD-766934; AFOSR-73-1650TR; SATR-1) Avail: NTIS CSCL 04/2

Results of the first 6-month effort include: (1) Formulation of a plan, acquisition of hardware, and development of programs to test and improve alternate transfer function techniques; (2) compilation of pollen data for 800 modern sites in eastern U.S.; (3) confirmation of a 60,000-year old sea-level high-stand on Barbados; (4) confirmation in deep-sea core records of climatic cycles of 180,380, and 2500-year periods; (5) documentation of a 70-meter sea-level low following within 10,000 years of the last interglacial thermal maximum; (6) discovery of a set of deep-sea cores off North Carolina containing evidence of a shifting Gulf Stream during the last 10,000 years; (7) time-series analyses of a million-year climatic record from the Pacific indicating that changes in the earth's solar orbit are in fact important influences controlling global climate change; (8) finalization of plans for the first ARPA-CLIMAP Global Atmosphere-Ocean Modelling Experiment, which will test the ability of the Mintz-Arakawa general circulation model to explain global climatic patterns 18,000 YBP, during a maximum of the last ice age.
Author (GRA)

N74-10412# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Aeronomy Lab.
CORRELATIONS BETWEEN EXOSPHERIC TEMPERATURE AND VARIOUS INDICATORS OF SOLAR ACTIVITY Interim Report
Jeffrey M. Forbes and Ronald M. Straka 21 Jun. 1973 22 p refs
(AF Proj. 8666)
(AD-766421; AFCRL-TR-73-0378; AFCRL-ERP-450) Avail: NTIS CSCL 04/1

A single-parameter correlation analysis is performed between nighttime minimum exospheric temperatures obtained during 1966-1970, as determined from satellite drag data and a Jacchia model, and various indicators of solar activity. These include Sagamore Hill radio fluxes between 606 and 8800 MHz, Ottawa 2800 MHz radio fluxes, HeII(304A) fluxes, and CaII indices. Results show that no one of these indicators stands out as best describing exospheric temperature variations under all conditions, although radio fluxes near 1415 MHz appear to give slightly better results during periods of low solar activity. The relative performance of the solar indices is not consistent on a year-to-year basis. It is concluded that a better representation might be obtained with a multi-parameter fit to the temperature data, including different weighting factors for the solar indices at different parts of the solar cycle. Author (GRA)

N74-10413# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Aeronomy Lab.
PROPAGATION OF INTERNAL GRAVITY WAVES IN A MEDIUM OF WEAK RANDOM VERTICAL SHEAR Interim Report
Jeffrey M. Forbes 21 Jun. 1973 24 p refs
(AF Proj. 6690)
(AD-766425; AFCRL-TR-73-0377; AFCRL-ERP-449) Avail: NTIS CSCL 20/4

The dispersion relation is derived for the ensemble-averaged wave in a Boussinesq fluid with a weak random vertical shear. The basic flow is assumed to be statistically homogeneous in space and time with zero mean. The phase velocity and decay rate are found for the two limiting cases where the wavelength is much greater and much smaller than the correlation length of the basic flow speeds. The decay rate is found to increase as the direction of propagation becomes more horizontal. However, the maximum decrease in phase velocity is found to occur when the wave is propagating at an angle of 50 degrees to the horizontal. These results are compared to those previously published (Keller and Veronis, 1969) for the analogous problem of Rossby waves propagating in the presence of random zonal currents that vary with latitude. Author (GRA)

N74-10414# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Aeronomy Lab.
WIND ESTIMATES NEAR 150 km FROM THE VARIATION IN INCLINATION OF LOW-PERIGEE SATELLITE ORBITS Interim Report
Jeffrey M. Forbes 21 Jun. 1973 17 p refs
(AF Proj. 6690)
(AD-766422; AFCRL-TR-73-0379; AFCRL-ERP-451) Avail: NTIS CSCL 04/1

Precise orbit determination of five Air Force low-altitude satellites are used to estimate winds near 150 km variations in the satellite orbital inclinations. Zonal winds determined by this method range from 25 to 200 m/sec during quiet to moderately disturbed geomagnetic conditions, to winds on the order of 300 to 600 m/sec during active geomagnetic conditions. Comparisons are made with other wind data and appropriate theories. Author (GRA)

N74-10446 Institut Franco-Allemand de Recherches, St. Louis (France).
LATITUDE DEPENDENCY OF STRATOSPHERIC AEROSOL LAYER [BREITENABHAENGIGKEIT DER AEROSOL-SCHICHT DER STRATOSPHAERE]
F. Roessler *In its* Papers on Ballistics and Phys. of Transience 1973 p 200-212 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

N74-10881 Joint Publications Research Service, Arlington, Va.
SESSION ON SPACE RESEARCH REPORTED
Gy. Major, K. Orendi, E. Borbely, T. Tanczer, B. Kozak, and P. Ambrozy *In its* Transl. on Eastern Europe: Sci. Affairs, No. 359 (JPRS-66224) 9 Oct. 1973 p 1-5 refs Transl. into ENGLISH from Idojaras (Budapest), May-Jun. 1973 p 190-192 (For availability see N74-10880 01-34)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N74-10415* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ULTRASONIC SCANNER FOR RADIAL AND FLAT PANELS Patent
Robert L. Spencer and Ewing K. Hill, inventors (to NASA) Issued 16 Oct. 1973 8 p Filed 27 Mar. 1972 Supersedes N72-27421 (10 - 18, p 2426)
(NASA-Case-MFS-20335-1; US-Patent-3,765,229; US-Patent-Appl-SN-238263; US-Patent-Class-73-67.8S) Avail: US Patent Office CSCL 14B

An ultrasonic scanning mechanism is described that scans panels of honeycomb construction or with welded seams. It incorporates a device which by simple adjustment is adapted to scan either a flat panel or a radial panel. The supporting structure takes the form of a pair of spaced rails. An immersion tank is positioned between the rails and below their level. A work holder is mounted in the tank and is adapted to hold the flat or radial panel. A traveling bridge is movable along the rails and a carriage is mounted on the bridge.
Official Gazette of the U.S. Patent Office

N74-10416 National Lending Library for Science and Technology, Boston Spa (England).
A STUDY ON THE MEASUREMENT OF POTENTIAL IN CHARGED OIL BY THE PROBE METHOD
M. Arimoto and T. Otaka Jul. 1973 25 p refs Transl. into

ENGLISH from Nagaoka Kogyo Koto Senmon Gakka Kenkyu Kiyo (Nagaoka), v. 8, no. 2, 1972 p 19-27 (103-111)
(NLL-RTS-8018) Avail: Natl. Lending Library, Boston Spa, Engl.: £12.40 or 8 NLL photocopy coupons

The potential in charged oil was measured by the probe method in which the potential was determined by considering the leakage current from the probe. A direct current high voltage was impressed on a measuring tank to provide an electric potential space charge whose potential is constant against time. Kerosene was used as the insulating fluid. An equivalent circuit corresponding to the leakage currents in the measurement system was found. The effects of these currents on probe characteristics are discussed along with a method of correction. K.M.M.

N74-10417*# Princeton Univ., N.J. Dept. of Astrophysical Sciences.
STRATOSCOPE 2 INTEGRATING TELEVISION CAMERA Final Report
8 Jun. 1973 76 p
(Contract NAS8-27687)
(NASA-CR-124472) Avail: NTIS HC $6.00 CSCL 14E

The development, construction, test and delivery of an integrating television camera for use as the primary data sensor on Flight 9 of Stratoscope 2 is described. The system block diagrams are presented along with the performance data, and definition of the interface of the telescope with the power, telemetry, and communication system. Author

N74-10418*# Fairchild Space and Defense Systems, Syosset, N.Y. Solid State Imaging Systems Section.
SOLID STATE HIGH RESOLUTION MULTI-SPECTRAL IMAGER CCD TEST PHASE Final Report, 15 Dec. 1971 - 30 Apr. 1973
1 May 1973 129 p
(Contract NAS5-21597)
(NASA-CR-132833; ED-AX-12) Avail: NTIS HC $8.50 CSCL 14B

The program consisted of measuring the performance characteristics of charge coupled linear imaging devices, and a study defining a multispectral imaging system employing advanced solid state photodetection techniques. Author

N74-10419*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A REACTIVE TORQUE CONTROL LAW FOR GYROSCOPICALLY CONTROLLED SPACE VEHICLES
John E. Farmer 24 Aug. 1973 23 p refs
(NASA-TM-X-64790) Avail: NTIS HC $3.25 CSCL 22B

A method of control is developed based on the reactive torques as seen by the individual CMG gimbals. The application of a torque to the gimbal of a CMG rotates the momentum vector and applies a torque to the spacecraft according to well-known laws. The response (rotation) of the vehicle produces a reverse or reaction torque opposing the torque producing the gimbal movement. The reactive torque and the pseudoinverse control schemes are contrasted in order to point out the simplicity of the first method. Simulation was performed only to the extent necessary to prove that reactive torque stabilization and control is feasible. Author

N74-10420*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATIC FOCUS CONTROL FOR FACSIMILE CAMERAS Patent Application
Archibald R. Sinclair, Ernest E. Burcher, and Stephen J. Katzberg, inventors (to NASA) Filed 15 Oct. 1973 12 p
(NASA-Case-LAR-11213-1; US-Patent-Appl-SN-406715) Avail: NTIS HC $3.00 CSCL 14E

A movable stage contains two photodetectors for focusing, as well as an imaging sensor. The imaging sensor produces the video data in the fashion standard to facsimile cameras. The two photodetectors are placed with one closer to the lens of the facsimile camera than the imaging sensor and with the other farther away. The movable stage is coupled to a linear motor which is driven from an error signal generated by the electronics. In order to insure that the electrical signals at the output of the two photodetectors and the imaging sensor are in phase, electrical delays are connected to the outputs of the two photodetectors. NASA

N74-10421*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif.
A METER FOR USE IN DETECTING TENSION IN STRAPS HAVING PREDETERMINED ELASTIC CHARACTERISTICS Patent Application
George V. Buhler and Dale E. Havens, inventors (to NASA) Filed 11 Oct. 1973 14 p Sponsored by NASA
(NASA-Case-MFS-22189-1; US-Patent-Appl-SN-405342) Avail: NTIS HC $3.00 CSCL 14B

A description is given of a meter for use in detecting tension in fabric straps having predetermined elastic characteristics. The meter is characterized by a pair of elongated arms disposed in juxtaposed, substantial parallelism, a clevis interconnecting the arms for pivotal motion in a common plane about a common axis, and a pair of juxtaposed receivers integrally related with the first ends of the arms and supported for arcuate motion. The receivers are configured to receive and secure a pair of adjacent portions of a fabric strap, and a pressure-responsive device. The device is mounted at the second ends of the arms for measuring and indicating the magnitude of arcuate motion imparted to the receivers as tension-induced stretching of the strap occurs. NASA

N74-10422*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AUTOMATIC MICROBIAL TRANSFER DEVICE Patent Application
Judd R. Wilkins and Stacey M. Mills, inventors (to NASA) Filed 26 Oct. 1973 10 p
(NASA-Case-LAR-11354-1; US-Patent-Appl-SN-409990) Avail: NTIS HC $3.00 CSCL 14B

An apparatus is disclosed for automatically transferring a predetermined amount of inoculated culture from a first container into a second container which has a sterile culture. The containers rest on the top of a pivoted support surface, where a horizontally disposed conduit connects them. The support surface is pivoted from its normal horizontal position by a solenoid which is activated under the control of an electrical timer. The solenoid is connected to a catch which may be disposed in two positions. When the solenoid is inactive, the catch is connected to the first end of the support surface to hold it in its normal horizontal position. When the solenoid is activated, the catch releases the support surface into a freely pivoting state. Upon release of the catch from the support surface, a weight disposed on the second end of the support surface tips the support surface from its normal horizontal position causing the predetermined volume of inoculated culture to flow into the second container. NASA

N74-10423# Pacific Northwest Forest and Range Experiment Station, Portland, Oreg.
AN INEXPENSIVE METEOROLOGICAL RADIATION SHIELD FOR THERMISTORS AND THERMOCOUPLES
Richard J. Barney Oct. 1972 8 p refs
(PNW-190) Avail: NTIS HC $3.00 CSCL 14B

An inexpensive, easily fabricated meteorological radiation shield for thermistors or thermocouples is described. Comparisons with standard wooden cotton region type shelters show good agreement. Author

N74-10424# Defence Standards Labs., Maribyrnong (Australia).
ELECTROCHEMICAL ASPECTS IN THE FAILURE OF DEWPOINT SENSING ELEMENTS
N. S. Dempster and B. A. Wilson May 1973 12 p ref
(TM-53) Avail: NTIS HC $3.00

Failure of gold electrodes on dewpoint sensing elements was found to be due to the use of an asymmetric ac power supply. The resultant dc current in the system caused the formation of aurous chloride in the lithium chloride medium. The aurous chloride is unstable and metallic gold is formed by the reaction $3Au(+) \rightarrow Au(+++) + 2Au$. Finely divided gold was precipitated around the anodic wire while elemental gold was plated out around the cathodic wire, leading to failure by bridging of the electrodes. Investigations showed that a high

frequency pure ac power supply was needed to eliminate this problem. Author

N74-10425# Swiss Inst. of Meteorology, Zurich.
EXPERIENCES WITH ELEVATED AND GROUND LEVEL STEREO AND TILTED STORAGE GAUGES IN THE BASIN OF BAYE DE MONTREUX. EFFECT OF TEMPERATURE ON THE PRECIPITATION MEASUREMENT BY MEANS OF STORAGE GAUGES
Boris Sevruk 1973 21 p refs in GERMAN; ENGLISH summaries
(Rept-30) Avail: NTIS HC $3.25

The problems of precipitation measurement by means of Swiss storage gauges are discussed briefly. The evaporation losses from Swiss storage gauges and the change of volume of calcium chloride solution in relation to the solution temperature are investigated. The results obtained with precipitation measurements over a period of 19 years in the pre-Alpine basin of Baye de Montreux show that stereo or tilted storage gauges are advantageous for measurements on steep, open slopes exposed to rain-bearing winds. In such locations the stereo or tilted gauges in the proximity of the ridge yield precipitation figures about twice as high as collected by horizontal orifices. In the wooded zone and in sheltered locations the stereo orifices yield only a small increase or none at all. The increase of precipitation with altitude is more clearly evident in the values of the instruments with orifice surfaces parallel to the slope than in those with horizontal orifices. There is only a slight difference between the rain catch of stereo and tilted gauges. In locations exposed to the wind the ground level stereo gauges show about 8% more rain catch than the elevated stereo gauges. Author

N74-10426*# RAND Corp., Santa Monica, Calif.
CONTROL POINT MEASUREMENTS ON MARINER 9 PICTURES Final Report
Merton E. Davies Jul. 1973 138 p refs Prepared for JPL (Contracts NAS7-100; JPL-953011)
(NASA-CR-135983; R-1332-JPL) Avail: NTIS HC $9.00 CSCL 14E

Measurements are given of the control points on the Mariner 9 pictures which were used in the computation of the June 1973 control net of Mars. The method of making the measurements is discussed along with the picture coordinate system and the removal of distortions. Table are presented of the 9804 measurements of 1645 points on 660 pictures. Author

N74-10427*# RAND Corp., Santa Monica, Calif.
MARINER 9 CONTROL NET MARS, JUNE 1973
Merton E. Davies Jun. 1973 93 p refs Prepared for JPL (Contracts NAS7-100; JPL-953011)
(NASA-CR-135985; R-1309-JPL) Avail: NTIS HC $6.75 CSCL 14E

The latitude and longitude are reported for 1645 primary points in the control net of Mars. The points were derived from Mariner 9 photographs as of June 1973. The new Mariner 9 aerographic coordinates system used in performing the computations is discussed. Author

N74-10428*# RAND Corp., Santa Monica, Calif.
MARINER 9 CONTROL NET OF MARS, AUGUST 1972 Final Report
Merton E. Davies Oct. 1972 104 p refs Prepared for JPL (Contracts NAS7-100; JPL-953011)
(NASA-CR-135987; R-1122-JPL) Avail: NTIS HC $7.25 CSCL 14E

Results are presented for a planet-wide geodetic control net of Mars which is based on Mariner 9 pictures as of August 1972. Aerocentric and aerographic coordinate of 809 control points were computed from 407 television frames. Photogrammetric parameters and methodology used in the computations are discussed. The coordinates of the features are given and figures that show the locations of the control points on the surface of Mars are included. K.M.M.

N74-10429# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF A PORTABLE PHOTOMETER TO MEASURE THE LIGHT OUTPUT OF INSTALLED IN-PAVEMENT LIGHTING FIXTURES Final Report, Jun. - Aug. 1973
Raymond E. Johnston and E. Leon Reamer Nov. 1973 13 p (FAA-NA-73-84; FAA-RD-73-157) Avail: NTIS HC $3.00

The purpose of this effort was to determine the suitability of a portable photometer to rapidly measure the light output of inset runway lights. The work involved: (1) laboratory measurements to compare the experimental unit with a standard laboratory photometer, (2) field measurements of inset lighting, and (3) analysis of the photometer construction. The result of the tests indicates that the portable photometer was adequate for the measurement of L-850a inset lights, but that some minor changes should be incorporated in the final design to make the unit more rugged and to permit measurement of more than one fixture type. Author

N74-10430*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARINER 9 INFRARED INTERFEROMETER SPECTROMETER (IRIS) REDUCED DATA RECORDS DOCUMENTATION
Oct. 1973 48 p refs
(NASA-TM-X-70504; X-622-73-305) Avail: NTIS HC $4.50 CSCL 14B

The Mariner 9 spacecraft was successfully inserted into orbit around Mars. One of the five instruments on board, an infrared interferometer spectrometer is used to record the thermal emission spectrum of Mars between 200 and 2000 cm/1. The spatial resolution for vertical viewing is a circular area of approximately 110 km diameter for a periapsis height of 1400 km. The total number of calibrated spectra included in the final data set is 21167. The final calibrated thermal emission spectra contained in the reduced data records are reported. Author

N74-10431# Institute TNO for Mechanical Constructions, Delft (Netherlands).
PROJECT ON NATO STANDARDS FOR SHOCK TESTING OF NAVAL EQUIPMENT. SHOCK MEASUREMENTS ON THE LIGHTWEIGHT SHOCK MACHINE HI LOCATED AT MEB OEGSTGEEST, NETHERLANDS
R. Regoord and R. A. P. J. Schulze Apr. 1973 46 p refs (SA-73013/15.26) Avail: NTIS HC $4.50

A description is given of a light weight shock testing machine (high impact) which is normally used to ascertain the shock resistance of naval equipment. The masses of equipment tested on this machine are limited to roughly 100 kg. The pieces of equipment are mounted by means of a shelf plate, on an anvilplate which is struck by either a swinging pendulum hammer or a falling drop hammer. The machine was loaded by a number of rigid test masses. Shock motion data were obtained by shock measurement equipment. Results are presented mainly by velocity signals and shock spectra. Additional acceleration signals and a Fourier spectrum are included. Author

N74-10432# Physics Lab. RVO-TNO, The Hague (Netherlands).
A DIGITAL SOUND MEASUREMENT SYSTEM FOR MINE SWEEPING. PART 1: THE DIGITAL TERTSBAND SPECTRAL ANALYZER
F. P. Ph. DeVries May 1973 31 p refs In DUTCH; ENGLISH summary
(Ph.L.1973.20-Pt-1) Avail: NTIS HC $3.75

A spectral analyzer is required to analyse the sound produced by a source in the sea. A digital spectral analyzer implemented with a minicomputer NOVA-800 is described. The principal part of the analyzer is a bank of terts-filters. The construction of this bank is discussed. Author

N74-10433*# California Univ., La Jolla. Physics Dept.
THE 3 DLE INSTRUMENT ON ATS-5 Final Technical Report
S. E. DeForest Jul. 1973 11 p refs
(Contract NAS5-10364)
(NASA-CR-132855) Avail: NTIS HC $3.00 CSCL 14B

The performance and operation of the DLE plasma electron counter on board the ATS 5 are described. Two methods of data presentation, microfilm line plots and spectrograms, are

discussed along with plasma dynamics, plasma flow velocity, electrostatic charging, and wave-particle interactions. K.M.M.

N74-10434*# Honeywell, Inc., Lexington, Mass. Radiation Center.
DEVELOPMENT OF A (Hg, Cd)Te PHOTODIODE DETECTOR, PHASE 2 Final Report, 19 May 1970 - Aug. 1972
Aug. 1972 64 p
(Contract NAS5-21197)
(NASA-CR-132861) Avail: NTIS HC $5.25 CSCL 14B

High speed sensitive (Hg,Cd)Te photodiode detectors operating in the 77 to 90 K temperature range have been developed for the 10.6 micron spectral region. P-N junctions formed by impurity (gold) diffusion in p-type (Hg, Cd) Te have been investigated. It is shown that the bandwidth and quantum efficiency of a diode are a constant for a fixed ratio of mobility/lifetime ratio of minority carriers. The minority carrier mobility and lifetime uniquely determine the bandwidth and quantum efficiency and indicate the shallow n on p (Hg,Cd) Te diodes are preferable as high performance, high frequency devices. Author

N74-10435# Institut Franco-Allemand de Recherches, St. Louis (France).
PAPERS ON BALLISTICS AND PHYSICS OF TRANSIENCE [BEITRAEGE AUS DER BALLISTIK UND KURZZEITPHYSIK]
R. E. Kutterer Bonn Bundeswehramt 1973 397 p refs In GERMAN; ENGLISH summaries Sponsored by Bundesmin. fuer Verteidigung
(BMVg-FBWT-73-15) Avail: NTIS HC $22.00; Bundeswehramt 25 DM

Contributions to the fields of ballistics and short duration phenomena are presented. The aims and development of the German-French research institute at Saint-Louis are highlighted. The Monte Carlo method was used to investigate the hit probability of an automatic gun. Gas dynamics were applied to interior ballistics. The penetration of a projectile in a metal plate was studied. Experimental results of transonic flow around slender bodies are reported. A qualitative analysis of artillery weapons is given. The temperature of the wake of an ablating projectile was spectroscopically measured. Particle tracks and velocity distributions in rifle powder gas plumes were recorded. The growth and properties of secondary explosive single crystals is discussed. Shock induced combustion by hypervelocity projectiles of methane mixtures was demonstrated. The latitude dependency of the stratospheric aerosol was pointed out. Lasers were used to photograph projectiles, to initiate explosions, and to measure projectile spin for schlieren holography. Telemetry of transmission from projectile is discussed. For individual titles, see N74-10436 through N74-10455.

N74-10436 Institut Franco-Allemand de Recherches, St. Louis (France).
DEVELOPMENT OF INTERNATIONAL SCIENTIFIC TECHNICAL INSTITUTIONS [ZUR ENTWICKLUNG INTERNATIONALER WISSENSCHAFTLICH-TECHNISCHER INSTITUTIONEN] **c34**
R. Schall *In its* Papers on Ballistics and Phys. of Transience 1973 p 4-14 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

The aims and development of the German-French research institute of Saint-Louis is highlighted against the development of international scientific-technical institutes, such as UNESCO, CERN, the science committee of NATO, etc. Factors are identified which have stimulated supranational cooperation and have led to the establishment of institutes, some of which are flourishing, others, however, in stagnation or even a critical state. ESRO

N74-10437 Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF THE RATE OF FIRING ON ACCURACY INVESTIGATED BY MEANS OF MONTE CARLO METHOD [MONTE-CARLO SPIELE ZUR UNTERSUCHUNG DES KADENZEINFLUSSES AUF DIE TREFFGENAUIGKEIT] **c19**
V. Fleck and H. Molitz *In its* Papers on Ballistics and Phys. of Transience 1973 p 15-34 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

The Monte Carlo method was used to investigate the effect of firing in cadences on the hit probability of automatic guns. When an automatic gun is fired, aiming errors no longer vary at random from one round to the next but show a more or less important correlation, depending on the firing rate. Thus the hit probability may be partly subject to high reductions, and it was found that an accurately firing gun does not always give best results. ESRO

N74-10438 Institut Franco-Allemand de Recherches, St. Louis (France).
GAS DYNAMIC METHODS IN THEORETICAL INTERIOR BALLISTICS [GASDYNAMISCHE METHODEN IN DER THEORETISCHEN INNENBALLISTIK] **c33**
G. Krauth *In its* Papers on Ballistics and Phys. of Transience 1973 p 35-47 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

The application to interior ballistics of gas dynamic analysis instead of thermodynamic analysis is discussed. An example of this method is elaborated for unsteady piston motion in a tube with combustion. The continuity, impulse, energy, and entropy relations are set-up and solved by difference methods, and by methods of characteristics. ESRO

N74-10439 Institut Franco-Allemand de Recherches, St. Louis (France).
SOME TERMINAL BALLISTICS PROBLEMS [EINIGE ENDBALLISTISCHE PROBLEMS] **c32**
G. Weihrauch *In its* Papers on Ballistics and Phys. of Transience 1973 p 48-76 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

An experimental arrangement for impact tests is described, and fundamental concepts of the penetration of an armour plate by a classic projectile are discussed. The deformation of a metal cylinder, impacting or penetrating a metal target at a velocity in the range of 50 m/s to 1500 m/s, is dealt with. In this experiment, plastic or even hydrodynamic deformation is observed. The displacement of the target material in front of the projectile is analyzed. ESRO

N74-10440 Institut Franco-Allemand de Recherches, St. Louis (France).
TRANSONIC FLOW AROUND SLENDER BODIES [TRANSSONISCHE UMSTROEMUNG SCHLANKER KOERPER] **c01**
Marc Giraud *In its* Papers on Ballistics and Phys. of Transience 1973 p 77-95 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

Experimental results of transonic flow around slender fin-stabilized bodies of revolution in a ballistic range are reported. The phenomena associated with transonic flow around a body of revolution are outlined. Both the effect of deceleration on the wave drag, and the effect of pendulation on the boundary layer transition are examined. ESRO

N74-10441 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz (West Germany).
THE MOST IMPORTANT TYPES OF ARTILLERY WEAPONS. COMPARISON OF THEIR PHYSICAL FUNCTIONS [DIE WICHTIGSTEN SCHUSSWAFFENTYPEN. PHYSIKALISCHER VERGLEICH IHRER FUNKTIONSWEISEN] **c34**
E. Zwarg *In* Inst. Franco-Allemand de Rech. Papers on Ballistics and Phys. of Transience 1973 p 96-123 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

The features of the most important types of artillery weapons are analyzed and compared. The types of weapon investigated are: conventional, recoilless, and solid rocket propelled. The principles of functioning and the differences involved are outlined, and a general comparison is made. The characteristic values of all weapons are calculated and compared for four different performances of known weapons having the same caliber. ESRO

N74-10442 Institut Franco-Allemand de Recherches, St. Louis (France).
SPECTROSCOPIC TEMPERATURE MEASUREMENT IN THE WAKE OF ABLATING FLYING DURALUMINUM SPHERES

[SPEKTROSKOPISCHE TEMPERATURMESSUNGEN IM NACHLAUF VON FREIFLIEGENDEN ABLATIERENDEN FLUGKOERPERN AUS DURAL] **c33**
H. Mach *In its* Papers on Ballistics and Phys. of Transience 1973 p 124-139 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

A light gas gun was used for launching duralumin spheres of diameter 8 mm into the air at velocities of about 4500 m/s. Ablation takes place, followed by combustion of the ablation products within the wake, in which case radiation from Al2O3 particles, a IO molecules and Al Atoms occurs. The AlO and Al temperatures were in good agreement whereas the Al2O3 particles showed a somewhat lower temperature. These measurements were performed over a distance ranging from the stagnation point to 250 times the diameter of the spheres. Author (ESRO)

N74-10443 Arbeitsgruppe fuer Ballistische Forschung, Weil am Rhein (West Germany).
FLOW INVESTIGATIONS AT BARREL MUZZLES USING LASER INDUCED GAS MOTION [STROEMUNGSUNTERSUCHUNGEN AN WAFFENMUENDUNGEN MITTELS LASERINDUZIERTEN GASDURCHBRUCHS] **c12**
G. A. Schroeder *In* Inst. Franco-Allemand de Rech. Papers on Ballistics and Phys. of Transience 1973 p 140-158 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

Examples are presented for the application of the technique of laser generated plasmas to recording of particle tracks and the determination of flow velocity distributions inside the powder gas plume of a 7.62 mm rifle. Plasma blobs generated by focusing intense laser radiation in a gas are well suited for tracing gas motion during a short time, such as in the powder gas plume formed in front of the muzzle of a barrel during projectile exit. Limitations of the method are discussed. ESRO

N74-10444 Institut Franco-Allemand de Recherches, St. Louis (France).
GROWTH AND INVESTIGATION OF SOME PROPERTIES OF EXPLOSIVES SINGLE CRYSTALS [SPRENGSTOFFEINKRISTALLE, IHRE ZUECHTUNG UND UNTERSUCHUNG EINIGER EIGENSCHAFTEN] **c33**
H. W. Koch *In its* Papers on Ballistics and Phys. of Transience 1973 p 159-184 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

Single crystals of a few secondary explosions were grown, and some of their properties investigated. The explosives examined were: hexogene, octogene, and nitropenta. The factors affecting the crystal growth are indicated and the growing techniques used are described. Details are given about the linear rate of growth, and a few criteria concerning the purity of the crystals are mentioned. Findings from experiments conducted on some crystal surfaces and along the crystal axes to determine physical properties are reported. These properties are: (1) linear elongation coefficient, (2) critical surface tensions, (3) spectral absorption, (4) piezo-electric, effect (5) sensitivity to detonation shock, and (6) detonation velocity. ESRO

N74-10445 Institut Franco-Allemand de Recherches, St. Louis (France).
TESTS ON SHOCK INDUCED METHANE COMBUSTION [UEBER EINIGE VERSUCHE ZUR STOSSINDUZIERTEN VERBRENNUNG VON METHAN] **c33**
H. F. Lehr and H. Behrens *In its* Papers on Ballistics and Phys. of Transience 1973 p 185-199 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

A series of experiments intended to demonstrate the shock induced combustion of methane mixtures is reported. The testing equipment is described. Results obtained by means of projectiles with differently shaped points shot into methane mixtures with oxygen, as well as with any possible additions of nitrogen and/or argon, are also presented. ESRO

N74-10446 Institut Franco-Allemand de Recherches, St. Louis (France).
LATITUDE DEPENDENCY OF STRATOSPHERIC AEROSOL LAYER [BREITENABHAENGIGKEIT DER AEROSOLSCHICHT DER STRATOSPHAERE] **c13**
F. Roessler *In its* Papers on Ballistics and Phys. of Transience 1973 p 200-212 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

The latitude dependency of the ionospheric aerosol layer was investigated. Different methods make it possible to prove the presence of an aerosol layer in the stratosphere at about 20 kilometers altitude. The initial counting of the particles themselves was completed by measurements on the twilight and diffuse skylight. Probing of the layers was achieved by using searchlight projectors, in which case the decrease in luminosity and traveling time of a pulsed laser beam were analyzed. Both the attenuation of the direct solar radiations in the atmosphere and the crepuscular aureole of the earth observed from a satellite were also investigated. These data were submitted to synthesizing analysis. Author (ESRO)

N74-10447 Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF A LASER BEAM ON IMMOBILE OR MOBILE TARGETS [EINFLUSS EINES LASERSTRAHLES AUF FESTSTEHENDE ODER BEWEGTE ZIELE] **c16**
H. Fagot *In its* Papers on Ballistics and Phys. of Transience 1973 p 213-224 refs In GERMAN; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais (For availability see N74-10435 01-14)

The breakdown of a light beam from a ruby laser (smaller than or equal to 20 MW-1J) was induced by focusing the light beam on metal or plastic targets. The weak shock wave generated in this way was investigated using the schlieren technique and the time resolution of the light emission. Photographs were taken of the breakdown occurring on the head and the side of supersonic projectiles 90 and 9 mm in diameter. The experiments have shown that it is possible to use Q switched lasers for the diagnosis of aerodynamic flow around flying models. ESRO

N74-10448 Institut Franco-Allemand de Recherches, St. Louis (France).
LASER INDUCED INITIATION OF EXPLOSIVES [UEBER DIE INITIIERUNG VON SPRENGSTOFFEN DURCH LASERSTRAHLUNG] **c16**
K. Vollrath, G. Gulitz, M. Hugenschmidt, and A. Hirth *In its* Papers on Ballistics and Phys. of Transience 1973 p 225-251 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

Results of experiments concerning the initiation of the explosive PETN (pentaerythrite-tetranitrate-nitropenta) by means of neodymium and ruby lasers are reported. Detonation can be obtained by using lasers in the normal relaxation mode, by means of an absorbing layer between explosive and the radiation entrance window. The detonation needs a certain spatial build-up and a time delay to take place. ESRO

N74-10449 Institut Franco-Allemand de Recherches, St. Louis (France).
FRAMING CAMERA FOR BALLISTIC PHOTOGRAMMETRY [EINE REIHENBILDKAMERA FUER DIE BALLISTISCHE PHOTOGRAMMETRIE]
H. Lukanow *In its* Papers on Ballistics and Phys. of Transience 1973 p 252-259 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

A framing camera for ballistic photogrammetry is described. The camera has a construction similar to a theodolite, and uses 70 mm perforated film. It operates at framing rates of 50 and 100 pictures/sec. The corresponding image sizes are 10 x 56 mm and 5 x 56 mm, respectively. A straightforward method permits synchronizing several cameras for recording moving phenomena in space. ESRO

N74-10450 Institut Franco-Allemand de Recherches, St. Louis (France).
MEASUREMENT OF PROJECTILE SPIN BY POLARIZED LIGHT [GESCHOSSDRALLMESSUNG MIT POLARISIERTEM LICHT]
Raymond Meyer and A. Stenzel *In its* Papers on Ballistics and Phys. of Transience 1973 p 260-270 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

The technique described is based on the well-known optical effect which consists in modulating the intensity of a linearly polarized beam of light by the motion of a polarization filter

rotating with respect to the direction of polarization. The nose of the projectile is equipped with a small reflector made by superposing a polarization foil and a totally reflecting foil. The rotating projectile flies in a linearly polarized beam of light emitted in a direction opposite to that of the trajectory. The incident light is largely reflected against the direction of incidence and this almost independently of the angle of incidence. It undergoes a modulation of its intensity which can be recorded by means of a detector placed close to the incident light beam. The modulation frequency equals the double rotation frequency of the projectile. First measurements performed on lead bullets fired with air guns and on conventional infantry ammunition have confirmed the applicability of this technique. Author (ESRO)

N74-10451 Institut Franco-Allemand de Recherches, St. Louis (France).
APPLICATION OF OPTICAL METHODS IN THE BALLISTIC RANGE [ANWENDUNG OPTISCHER METHODEN IN DER FREIFLUGANLAGE]
P. Smigielski, H. Royer, and F. Albe *In its* Papers on Ballistics and Phys. of Transience 1973 p 271-295 refs In GERMAN; ENGLISH summary Sponsored in part by Direc. des Rech. et Moyens d'Essais (For availability see N74-10435 01-14)

Some new experimental techniques for application to ballistic investigations are described: (1) analysis of holograms by means of coherent schlieren methods with defocusing of the phase filter (half-plane with a 180 deg phase shift); (2) wake visualization by using both differential interferometry and (3) amplitude subtraction schlieren methods. These methods were examined, but have not yet been evaluated. ESRO

N74-10452 Institut Franco-Allemand de Recherches, St. Louis (France).
STATE-OF-THE-ART OF TELEMETRY DATA TRANSMISSION FROM HIGHLY ACCELERATED PROJECTILES [ENTWICKLUNGSSTAND DER DATENTELEMETRIE AUS HOCHBESCHLEUNIGTEN GESCHOSSEN] c07
B. Koch *In its* Papers on Ballistics and Phys. of Transience 1973 p 296-315 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

A review is presented of studies undertaken in order to resolve the telemetry data transmission problem from projectiles submitted to very high accelerations during the launching period (over 1000 g). The studies carried out deal primarily with the transmission of ballistic and aerodynamic data, in free flight, which are of significance to investigations in the field of aeroballistics and physics of flow related to high and very high velocities, e.g. simulation of reentry phenomena by means of light gas launcher operation. ESRO

N74-10453 Institut Franco-Allemand de Recherches, St. Louis (France).
TELEMETRY TRANSMITTER FOR DATA TRANSMISSION FROM SMALL AND MEDIUM CALIBER PROJECTILES IN ACCELERATION RANGE FROM 5000 TO 100000 G [MESSWERTSENDER ZUR DATENUEBERTRAGUNG AUS GESCHOSSEN KLEINER UND MITTLERER KALIBER FUER DEN BESCHLEUNIGUNGSBEREICH VON 5000 BIS 100000 G] c07
G. Schultze *In its* Papers on Ballistics and Phys. of Transience 1973 p 316-342 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

Problems are discussed involving the development and construction of projectile-borne telemetering devices capable of withstanding high accelerations. The acceleration range is 5,000 to 100,000 g. Prior to use, each component and construction unit must be checked as to its electric stability and mechanical resistance to acceleration. This was accomplished by a series of test firings. A telemetry system is described which can withstand high accelerations and consists of seven construction units which were developed by using the silk screen printing technique. The problems involved in the design of telemetry transducers for ballistic data transmission are discussed. Author (ESRO)

N74-10454 Institut Franco-Allemand de Recherches, St Louis (France).
STREAK INTERFEROMETRY [STREAKINTERFEROMETRIE]
G. Smeets *In its* Papers on Ballistics and Phys. of Transience 1973 p 343-352 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

Interference figures visualize phase objects that can be measured quantitatively. Instead of two-dimensional picture information given by an instantaneous photograph, pictures taken by means of a streak camera provide space-time information in which case only one-dimensional spatila information is given along the slit. Appearance and nature of information of the interference figures taken by a streak camera are dependent on the arrangement of slit and interference fringes. Author (ESRO)

N74-10455 Institut Franco-Allemand de Recherches, St. Louis (France).
ABSORPTION AND CONTRAST IN FLASH RADIOGRAPHY [ABSORPTION UND KONTRAST IN DER ROENTGENBLITZ-PHOTOGRAPHIE]
G. Thomer and F. Jamet *In its* Papers on Ballistics and Phys. of Transience 1973 p 353-376 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

A theoretical and experimental analysis of the conditions enabling the attainment of optimal contrast was carried out in order to increase the amount of information available in flash radiography. A summary of X ray absorption diagrams for some materials, and a review of characteristic examples of application, are presented. ESRO

N74-10456# Royal Aircraft Establishment, Farnborough (England).
A MINIATURE CONDITIONING UNIT FOR INDUCTIVE TRANSDUCERS
W. R. MacDonald Jan. 1973 23 p refs
(RAE-TM-IR-134; BR33813) Avail: NTIS HC $3.25

The design features of a miniature conditioning unit for producing a voltage output from an inductive transducer are discussed. Small size was achieved by the use of a square wave rather than sine wave energization. Low carrier frequency and IC operational amplifiers are used. The transducer proper has a diaphragm of EN56A stainless steel. Both coils being protected by construction from the pressure medium, the transducer is suitable for measuring gage, absolute or differential pressure in fluids compatible with EN56A in the range of 33 kN/sq m to 33 MN/sq m. Transducer bridge characteristics, sine wave and square wave excitation, demodulator, output filter, and output amplifier characteristics are detailed. Semiconductor strain gages are compared to the inductance-type pressure sensor, and telemetry applications are indicated. ESRO

N74-10457# Rome Univ. (Italy). Inst. of Physics.
IMPROVEMENT OF THE RESOLVING POWER OF A TV SYSTEM
F. Cesaroni, U. Florean, and M. Severi 12 Jun. 1973 10 p refs
(Nota-Interna-475) Avail: NTIS HC $3.00

A TV camera for nuclear physics streamer chambers image recording is discussed. The improvement in resolving power by variation of the scanning speed and amplifier bandwidth reduction, without loss of information, is discussed. Special regard is given to image spatial localization by counting trains of pulses starting at the rise and fall times of the luminous signal and ending with the first line-end signal. The scanning speed varies between 52 and 240 microseconds. Measurements show that the signal amplitude variation is inversely proportional to the scanning speed and the effect depends on the characteristics of the TV tube. Compensation to this effect is obtained by reducing the amplifier bandwidth with correlative signal to noise ratio increase. The noise does not depend on the scanning speed. An overall gain in sensitivity is obtained. ESRO

N74-10458# Geneva Univ. (Switzerland).
MODEL AD-104 AMPLIFIER-DISCRIMINATOR FOR SINGLE PHOTOELECTRON COUNTING
Daniel A. Huguenin [1972] 27 p refs
Avail: NTIS HC $3.50

The model AD-104 amplifier-discriminator for single photoelectron counting is a charge sensitive amplifier-discriminator delivering one standard output pulse for each anode pulse whose charge exceeds a fixed threshold at a level of 10 to 20% of the

mean single photoelectron anode charge. The charge to voltage conversion of the anode pulse is performed by a passive input integrator. With a moderate photomultiplier gain this integrator produces a usable signal (12.5 mV average). The advantages of such a system are described as: the counting efficiency is not affected by variations in focusing or transit time spread of the tube; the voltage gain of the amplifier section, which is supplied by one single integrated circuit, is only 24; the anode load is a 15 pF capacitance. It is almost a short circuit above 150 MHz hence the noise immunity is improved. A detailed description of the instrument subsystems is given with regard to amplifier housing, input charge integrator, unity gain buffer, pulse shaping, widebased amplifier, baseline restorer, discriminator, line driver. Procedures to reduce RF interference, selection of photomultiplier tube gain, connection circuit, interfaces, HV, together with a recommended interconnection and grounding diagram are given. Applications to spaceborne astronomy, image dissectors, telescope tube guidance and photoelectric detectors, are given. ESRO

N74-10459# Institut Franco-Allemand de Recherches, St. Louis (France).
DUAL EXPOSURE INTERFEROMETRY [DOPPELBELICHTUNGS-INTERFEROMETRIE]
G. Smeets and A. George 4 Dec. 1972 22 p refs In GERMAN
(ISL-39/72) Avail: NTIS HC $3.25

The application of dual exposure differential interferometry to gas-dynamics and flow visualization is discussed. A differential interferometer with Wollaston prisms can produce two complementary interference fringe systems, depending on the polarization of the incident light. If these two systems are superimposed on a film, with one exposure during a phenomenon, the other before or after, the phenomenon will appear on a uniform background. By regulating the interferometer to infinite fringe distance, a resolution limit of approximately lambda/500 can be obtained in the quantitative analysis of weak phase objects. This method was successfully applied to gas dynamic investigations. ESRO

N74-10460# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC CALIBRATION OF ICE FORMING CLOUDS [ETALONNAGE D'UN BROUILLARD GIVRANT PAR HOLOGRAPHIE]
H. Royer 19 Jan. 1973 45 p refs In FRENCH
(Contract CEPr-72/0126)
(ISL-5/73) Avail: NTIS HC $4.25

Ruby laser holograms of ice forming clouds in a high altitude test cell were recorded. The following operational conditions were observed: 0.5 atm ambient pressure, 0 C temperature 100 m/sec particle velocity, and 5 to 50 micron drop size. The ice forming clouds were restituted and visualized in laboratory with a 1000 enhancement factor. Difficulties encountered due to the speckle and to television system defects were analyzed. Water concentration, size distribution of drops, mean volumetric diameter, as well as the homogeneity of the cloud were determined. Different factors affecting the measurement precision were examined. Means for optimization of the experiment are suggested. ESRO

N74-10461# Solar, San Diego, Calif.
TURBINE INLET GAS TEMPERATURE SENSOR FOR ENGINE CONTROL Final Report, May 1971 - Jan. 1973
Manfred I. Seegall, David A. Rohy, and William A. Compton Wright-Patterson AFB, Ohio AFFDL Feb. 1973 264 p refs (Contract F33615-71-C-1510; AF Proj. 1987)
(AD-765193; RDR-1748; AFFDL-TR-73-49) Avail: NTIS CSCL 21/5

A research and development program is described; the objective is the design, analysis, testing and demonstration of a nuclear radiation sensor system to measure the turbine inlet gas temperature. This sensor is constructed on the basis of the electron radiation beam, transmitted across the turbine flow duct, being attenuated proportionally to the gas density. A concurrently obtained pressure signal feeding into an electronic computing system generates, from the basic laws of electron beam attenuation and the gas law, a signal proportional to the mean gas temperature across the turbine flow duct. The sensor as a whole has been named the gas-temperature-density sensors. Author

N74-10462# Air Force Cambridge Research Labs., Newburyport, Mass.
A TWO-CHANNEL INTERFERENCE-FILTER PHOTOMETER DIGITAL RECORDING SYSTEM AT THE AFCRL GEOPOLE OBSERVATORY, THULE, GREENLAND
Edward G. Mullen, John W. F. Lloyd, and Daniel J. Davis, Jr. 18 Jun. 1973 20 p
(AF Proj. 7661)
(AD-766090; AFCRL-IP-189; AFCRL-TR-73-0366) Avail: NTIS CSCL 04/1

A two-channel digital photometer system installed at the AFCRL Geopole Observatory, Thule, Greenland is described, and data from the system over the 1972 to 1973 optical observing season are presented. Results show that intensities of (OI) (lambda) 5577 A can be obtained over long periods of time under varied observational conditions with high reliability. The system makes it economically feasible to study long- and short-term variations and correlations of fast time resolution optical data. Author (GRA)

N74-10463# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL STUDY OF THE PNEUMATIC ANGULAR RATE SENSOR M.S. Thesis
Daniel B. Mulligan Jun. 1973 71 p refs
(AD-765671) Avail: NTIS CSCL 13/7

The purpose of this investigation was to determine the response of a pneumatic angular rate sensor with two spherical pickoff elements, and to develop a suitable prototype sensor to be used in further analysis and experimentation. It was found that optimum response is obtained when the spherical elements are located within the sink tube, and that in the development of a suitable prototype, a fluid of relatively high density with low flow rates should be used to minimize system noise while retaining high system response. Author (GRA)

N74-10464# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USE OF NONCONTACT MAGNETO-ACOUSTIC TRANSDUCERS IN ULTRASONIC FLOW DETECTION
G. K. Ulyanov 6 Aug. 1973 12 p refs Transl. into ENGLISH from Tr. Inst. Aviats. Priborostr. (Leningrad), no. 45, 1965 p 27-32
(AD-765989; FTD-HT-23-697-73) Avail: NTIS CSCL 14/2

Described is the action principle and arrangement of a magneto-acoustic transducer. Results are given for volume and surface tests on ultrasonic waves in flaw detection. GRA

N74-10465*# New York Univ., N.Y. School of Engineering and Science.
TRENDS IN THE DEVELOPMENT OF AUTOMATIC TEST EQUIPMENT
Jack Lustig Jun. 1973 346 p Sponsored in part by NASA (Contract N00039-68-C-3579; Proj. XF013-17-01; Proj. SETE) (NASA-CR-135826; AD-765739) Avail: NTIS HC $19.50 CSCL 14/2

The study represents an effort to identify significant trends in the design of automated testing since the middle 1950's. It includes a number of pertinent philosophies of this period and provides some conclusions and recommendations for future automatic test equipment. Incorporated in the report are summations of a selection from twenty five hundred (2500) articles, reports and several hundred patents contained in the files of Project SETE; the results of a meeting at NASA Kennedy Space Flight Center; and a portion of the correspondence resulting from an industrial survey on automatic test equipment. A bibliography has been arranged chronologically to provide the reader with an additional tool for the historical assessment of automatic test equipment. The report is issued in three layers. The foreword represents the first layer and is essentially an introduction to automatic testing. It is prepared for those readers who desire only a brief discussion of the subject. The historical preview is the second layer. It explores in greater detail the ramifications of early efforts to automate testing. It includes a chronological programming sequence history chart plus samples of programming devices related to automatic test equipment.

Starting with task objectives the major part of the report is detailed. The main thrust is on important philosophies which played a part in the overall movement of automation in testing.
Author (GRA)

N74-10466# New York Univ., N.Y. School of Engineering and Science.
TRENDS IN THE DEVELOPMENT OF AUTOMATIC TEST EQUIPMENT, EXECUTIVE SUMMARY
Jack Lustig and David M. Goodman Jun. 1973 32 p
(Contract N00039-68-C-3579; XF013-17-01)
(AD-765738) Avail: NTIS CSCL 14/2

The study represents an executive summary of the complete document SETE 210/106 which identifies the significant trends in the design and utilization of automated test equipment since the middle 1950's. It includes the pertinent philosopies of this period and provides conclusions and recommendations for the future. (Modified author abstract) GRA

N74-10467# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN ANALYTICAL MODEL OF THE FERROELECTRIC RADIATION DETECTOR
J. Terrence Klopcic and Dail L. Swanson Jul. 1973 24 p refs
(DNA Proj. J11-AAXPX231)
(AD-766303; BRL-MR-2310) Avail: NTIS CSCL 18/4

As part of the Defense Nuclear Agency project J11 AAXPX231 to study the behavior of the ferroelectric radiation detector, an analytical model of the energy balance within a ferroelectric crystal has been developed. This model relates ionic spacing and charges to macroscopic quantities such as the pyroelectric and piezoelectric coefficients. Although a highly simplified model, resulting in calculations that can be handled by a desk top calculator, it accurately predicts those quantities of interest in analyzing normal ferroelectric radiation detector response. Because the model also accounts remarkably well for certain piezoelectric parameters, it appears that application may be extended to ferroelectric transducers and components other than radiation detectors. Author (GRA)

N74-10468# Singer Co., Little Falls, N.J. Kearfott Div.
EXPERIMENTAL EVALUATION OF VISCOUS VORTEX RATE SENSOR, PART 1 Final Report, 1 Oct. 1971 - 1 Jun. 1973
Michael J. DeSantis Jun. 1973 72 p refs
(Contract DAAG39-72-C-0014; DA Proj. 1T0-62114-A-643; HDL Proj. 301234)
(AD-766264; KD73-36-Pt-1) Avail: NTIS CSCL 14/2

The report presents a progress summary on the evaluation of a pneumatic viscous vortex rate sensor (VVRS). The objective was to investigate the flow field in a three-dimensional, axisymmetric device. The study is primarily experimental, utilizing hot-wire and hot-film anemometry techniques to measure velocity profiles and wall shear stress for both steady and non-steady flow conditions. Comparison of the experimental data will be made with a mathematical analysis developed by Harry Diamond Laboratories. (Modified author abstract) GRA

N74-10469# Singer Co., Little Falls, N.J. Kearfott Div.
EXPERIMENTAL EVALUATION OF VISCOUS VORTEX RATE SENSOR, PART 2 Final Report, 11 Jul. 1972 - 30 Jun. 1973
Michael J. DeSantis Jul. 1973 67 p
(Contract DAAG39-72-C-0014; DA Proj. 1T0-61102-A-33B; HDL Proj. 302231)
(AD-766265; KD73-37-Pt-2) Avail: NTIS CSCL 14/2

The report summarizes an experimental program to evaluate the performance of an HDL designed hydraulic viscous vortex rate sensor. The rate sensor consists of two coaxial cylindrical disks with an outlet tube located at the center of one of the disks. Radial inflow of the fluid develops into a sink flow with a vortex generated by an angular rate input through fluid-wall boundary viscous coupling. A sophisticated hydraulic facility with hydraulic oil as the working fluid was utilized to test the rate sensor under controlled fluid temperature, pressure, and flow rate. (Modified author abstract) GRA

N74-10470# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
RADIOGRAPHIC EQUIPMENT SET Final Report
26 Jan. 1973 15 p refs
(AD-759236; TOP-9-2-305) Avail: NTIS CSCL 14/2

A description is given of a method for evaluating the operational and functional performance characteristics of radiographic equipment. The report identifies supporting tests, facilities, and required equipment. Data are also given on safety procedures, operator training, initial inspection, physical characteristics, performance, environment, transportability, durability, human factors, and reliability testing. The method is applicable to portable radiographic equipment used in the evaluation of structural integrity and interior constitution of weldments, vehicle structures, castings, and assemblies such as ammunition fuzes and dud rounds. Medical equipment and climatic tests are excluded.
Author

N74-10471# Battelle Columbus Labs., Ohio.
DEVELOP AN OPERATIONAL SYSTEM FOR EVALUATING AND TESTING METHODS AND INSTRUMENTS FOR DETERMINING THE EFFECTS OF FUELS AND FUEL ADDITIVES ON AUTOMOBILE EMISSIONS Final Report
E. R. Blosser Feb. 1973 62 p refs
(Contract EPA-68-02-0324)
(PB-222334/5; EPA-R2-73-160) Avail: NTIS HC $5.25 CSCL 13B

Causes of observed weight variations in collected particulates from automobile exhaust were sought. Chemical and physical properties of unused glass fiber filters were studied, and some chemical analyses of collected exhaust particulates were performed. No clear indication of a single cause for the variations could be discerned. An extensive statistical analysis of data obtained from additional experiments is suggested as a means of pinpointing the causes of the weight variations.
Author (GRA)

N74-10472# Aerospace Corp., El Segundo, Calif.
FLUORINE PRESSURE CHANGE MONITOR FOR A REACTING SYSTEM Technical Report, May - Jul. 1971
Steven N. Suchard and Lee D. Bergerson 1 Sep. 1973 14 p refs
(Contract F04701-73-C-0074)
(AD-766259; TR-0074(4640)-2; SAMSO-TR-73-261) Avail: NTIS CSCL 14/2

Recent experimental results on the performance of a pulsed HF chemical laser have indicated that the presence of HF in the chemical reactants prior to laser initiation degrade the laser performance. In order to monitor the amount of HF produced when the chemical reactants are mixed, a device has been developed that measures the change in concentration of one of the reactants. This device, which relies on the absorption of light by molecular F2, has been shown to have an accuracy of better than 5 percent in the measurement of the F2 pressure.
Author (GRA)

N74-10473# Panametrics, Inc., Waltham, Mass.
PROTOTYPE PORTABLE ULTRASONIC SPECTROSCOPE Final Report, 26 Jan. 1972 - 26 May 1973
Kenneth A. Fowler, Gerald M. Elfbaum, Brian J. Spencer, and Jean L. Hunerwadel May 1973 29 p refs
(Contract DAAG46-73-C-0096)
(AD-766310; AMMRC-CTR-73-17) Avail: NTIS CSCL 14/2

A portable ultrasonic system designated as the Model 5030 Ultrasonic Spectroscope, has been completed. This system displays both the time-domain rf signal and the spectral content of selected portions of the signal on a single CRT. This advancement significantly reduces the complexity of operation with no loss in system capability. Typical uses of the system include thickness gaging, attenuation measurements, flaw characterization, and transducer evaluation. The characteristics and specifications of the system are summarized. The report also contains oscillograms of typical CRT displays and a bibliography of papers covering a variety of applications. Author (GRA)

N74-10255* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMOELECTRICALLY-COOLED QUARTZ CRYSTAL

MICROBALANCE
D. McKeown (Faraday, Labs., Inc.), W. E. Corbin, Jr. (Faraday, Labs., Inc.), and R. J. Naumann *In its* Space Simulation, 7th 1973 p 345-356 refs (For availability see N74-10232 01-11)
(Contracts NAS8-27879; NAS5-11163)
CSCL 14B

N74-10256* Celesco Industries, Costa Mesa, Calif.
DEVELOPMENT OF A MINIATURE CRYOGENIC QCM FOR LOW TEMPERATURE CONTAMINATION MEASUREMENT
D. A. Wallace *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 357-366 refs (For availability see N74-10232 01-11)
CSCL 14B

N74-10258* Aerospace Corp., El Segundo, Calif.
PHOTOGRAPHIC MEASUREMENT OF PARTICULATE SURFACE CONTAMINATION
O. Hamberg *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 379-399 refs (For availability see N74-10232 01-11)
CSCL 14E

N74-10259* General Electric Co., Philadelphia, Pa.
MEASUREMENT ON CONDENSATE FILM CONTAMINATION ON CRITICAL SURFACES BY CHARGED PARTICLE EXCITED X-RAY FLUORESCENCE
W. P. Saylor *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 401-419 refs (For availability see N74-10232 01-11)
CSCL 14B

N74-10272* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DEVELOPMENT OF TECHNIQUES FOR ADVANCED OPTICAL CONTAMINATION MEASUREMENT WITH INTERNAL REFLECTION SPECTROSCOPY
R. G. Richmond, J. D. Hayes (Teledyne-Brown Eng., Huntsville, Ala.), and N. E. Chatterton (Teledyne-Brown Eng., Huntsville Ala.) *In its* Space Simulation, 7th 1973 p 609-633 refs (For availability see N74-10232 01-11)
CSCL 14B

N74-10288* Northrop Services, Inc., Houston, Tex.
A VERSATILE INSTRUMENT FOR THERMAL RADIATION MEASUREMENT
Calvin M. Wolff *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 847-854 (For availability see N74-10232 01-11)
CSCL 14B

N74-10290* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ABSOLUTE TOTAL RADIATION RADIOMETER FOR MEASURING A WIDE RANGE OF IRRADIANCES IN SPACE SIMULATORS
J. M. Kendall, Sr. *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 867-874 refs (For availability see N74-10232 01-11)
CSCL 14B

N74-10883 Joint Publications Research Service, Arlington, Va.
FLUORESCENCE MICROSCOPE OF THE MIKROVAL TYPE FROM VEB CARL ZEISS JENA
L. Otto *In its* Transl. on Eastern Europe: Sci. Affairs, No. 359 (JPRS-66224) 9 Oct. 1973 p 8-19 refs Transl. into ENGLISH from Z. fuer Med. Labortech. (East Berlin), v. 14, no. 4, 1973 p 1-95-203 (For availability see N74-10880 01-34)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N74-10474* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPIRAL GROOVE SEAL Patent
Lawrence P. Ludwig, inventor (to NASA) Issued 23 Oct. 1973 4 p Filed 21 Dec. 1970
(NASA-Case-LEW-10326-3; US-Patent-3,767,212; US-Patent-Appl-SN-99901; US-Patent-Class-277-25; US-Patent-Class-277-27; US-Patent-Class-277-96) Avail: US Patent Office CSCL 13E

Mating flat surfaces inhibit leakage of a fluid around a stationary shaft. A spiral groove pattern produces a pumping action toward the fluid when the shaft rotates which prevents leakage while a generated hydraulic lifting force separates the mating surfaces to minimize wear.
Official Gazette of the U.S. Patent Office

N74-10475*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
JOURNAL BEARINGS Patent Application
Fredrick T. Schuller and Warren A. Moore, inventors (to NASA) Filed 11 Oct. 1973 12 p
(NASA-Case-LEW-11076-3; US-Patent-Appl-SN-405346) Avail: NTIS HC $3.00 CSCL 13I

The instability of zero or lightly loaded shafts when they rotate at high speeds in bearings in low viscosity lubricants is considered . This instability refers to a selfexcited fractional frequency whirl or tendency of the shaft center to orbit the bearing center at an angular velocity about half that of the shaft around its own center. These problems have been overcome by utilizing bearings of fixed geometry that use a plurality of sectors to provide lobed areas which function as a pump when the rotor turns. The resulting pressure distribution is similar to that obtained in a hydrostatic gas bearing.
NASA

N74-10476*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPARATUS FOR PRODUCING HIGH PURITY I-123 Patent Application
James W. Blue, inventor (to NASA) Filed 4 Sep. 1973 13 p
(NASA-Case-LEW-10518-3; US-Patent-Appl-SN-394207) Avail: NTIS . HC $3.00 CSCL 13I

A method is reported for producing high purity radioiodine for thyroid measurement and for use as a general radionuclide. The method involves the bombardment of tellurim power in targets with a cyclotron beam to produce Xe-123. Flowing gas streams carry the Xe-123 through one cold trap which removes contaminants to another cold trap which removes Xe-123 that subsequently decays to 1-123. During this bombardment energy is deposited in the target material causing its temperature to rise. Some of the tellurium vaporizes and subsequently condenses on surfaces that are cooler than the vaporization temperature. Provision is made for the repeated bombardment of this condensed tellurium.
NASA

N74-10477# National Aeronautical Establishment, Ottawa (Ontario). Structures Section.
IMPROVEMENT IN CABLE BARRIER DESIGN
G. F. W. McCaffrey Oct. 1972 29 p refs Presented at Ann. Conv. of the Roads and Transportation Assoc. of Can., Winnipeg, Manitoba, 2-5 Oct. 1973
(LTR-ST-621) Avail: NTIS HC $3.50

A review of current practices in highway barrier design is presented with particular emphasis on cable barriers. The development of a mathematical model for vehicle barrier dynamics and the design of experiments to validate the model are also reported. The importance of a number of design details on barrier performance is discussed and related to other barriers in current use.
Author

N74-10478*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
KSC LUBRICANT TESTING PROGRAM
Billy Joe Lockhart and Coleman J. Bryan Washington Nov. 1973 87 p
(NASA-TN-D-7372; KSC-MTB-032-70) Avail: NTIS HC $3.75 CSCL 11H

A program was conducted to evaluate the performance of various lubricants in use and considered for use at Kennedy Space Center (KSC). The overall objectives of the program were to: (1) determine the lubrication characteristics and relative corrosion resistance of lubricants in use and proposed for use at KSC; (2) identify materials which may be equivalent to or better than KELF-90 and Krytox 240 AC greases; and (3) identify or develop an improved lubricating oil suitable for use in liquid oxygen (LOX) pumps at KSC. It was concluded that: (1) earth gel thickened greases are very poor corrosion preventive materials in the KSC environment; (2) Halocarbon 25-5S and Braycote 656 were suitable substiutes for KELF-90 and Krytox 240 AC respectively; and (3) none of the oils evaluated possessed the necessary inertness, lubricity, and corrosion prevention characteristics for the KSC LOX pumping systems in their present configuration. Author

N74-10479# Royal Aircraft Establishment, Farnborough (England).
REPEATABLE CREEP AND RECOVERY DATA FROM TWO LABORATORIES
J. N. Webb Apr. 1973 37 p refs
(RAE-TR-73015; BR34838) Avail: NTIS HC $4.00

Creep tests on aluminum alloy to specification DTD 5070A were carried out in a commercial laboratory in an attempt to obtain the repeatability being achieved under nominally identical conditions. The results indicate that best commercial practice is not adequate for high accuracy repeatable data. Special methods to ensure axiality of loading and temperature control to closer tolerances were among the changes required before agreement was obtained. Author (ESRO)

N74-10480# Picatinny Arsenal, Dover, N.J.
EVALUATION OF THE ADHESIVE BONDING PROCESSES USED IN HELICOPTER MANUFACTURE. PART 4: NONDESTRUCTIVE INSPECTION OF ADHESIVE BONDS USING HOLOGRAPHIC TECHNIQUES
Modesto J. Barbarisi, Brian R. Chisholm, and Paul J. Kisatsky Oct. 1972 26 p
(AD-765455; PA-TR-4419-Pt-4) Avail: NTIS CSCL 13/8

Double exposure holographic techniques are used to nondestructively examine the condition of adhesive bonds in honeycomb panels. The panels are subjected to a high humidity environment which causes adhesive degradation. Periodically the panels are holographically examined. Observation of the fringe patterns reveals that the gradual degradation of the bond can be readily seen as the humidity attacks the adhesive starting with the outer edges, working its way inward. Two different prebonding preparation techniques are examined. The different rates of attack on the two types of panels are clearly recorded by the holographic technique. Since the panels were in no way destroyed or affected, these experiments give strong evidence of the power of optical holography as a nondestructive test which not only indicates disbonds but may even relate to bond strength or quality. Author (GRA)

N74-10481# Naval Ordnance Lab., White Oak, Md.
PRELIMINARY STUDY INTO SHELL MOLD CASTING OF NOMINAL 60-NITINOL ALLOY
William J. Buehler, Richard E. Jones, Ernest F. Heintzelman, and Richard H. Lundsten 12 Jul. 1973 28 p refs
(AD-765693; NOLTR-73-134) Avail: NTIS CSCL 13/8

The present study was initiated to determine the feasibility of shell mold casting nominal 60-Nitinol into suitable EOD (Explosive Ordnance Disposal) tools. Pr Primary emphasis was directed to alloy-mold interaction, effects of graphite mold coating, shrinkage and porosity problems, alloy fluidity, surface finish and definition and property response of cast alloy. Based upon the results, 60-Nitinol appears quite suited to shell molding and a casting approach, provided the alloy melting and casting are conducted in a vacuum or controlled inert atmosphere. The major area of possible future concern lies in the casting porosity associated with the relatively large liquid-to-solid shrinkage of nominal 60-Nitinol. Author (GRA)

N74-10482# Army Materials and Mechanics Research Center, Watertown, Mass.
DEVELOPMENT OF WELDING PRACTICES FOR TITANIUM ALLOY 8Mo-8V-2Fe-3Al
William P. Hatch Mar. 1973 53 p refs
(AD-765448; AMMRC-PYR-73-4) Avail: NTIS CSCL 13/8

An evaluation of the weldability of the metastable beta Ti-8Mo-8V-2Fe-3Al alloy was conducted. The material was evaluated in sheet and plate thickness of 1/16 in., 1/8 in., 1/4 in. and 1/2 in. The welding process was limited to the Gas Tungsten Arc method done outside an inclosure with an auxiliary trailing shield. No problems were encountered in producing sound welds. Heat treat practices which produced 100% tensile efficiency in weld joints were developed, and weld toughness determined by Charpy impact testing was equivalent to current state-of-the-art for the high strength levels examined. Author (GRA)

N74-10483# Defense Documentation Center, Alexandria, Va.
VAPOR PLATING Report Bibliography, Oct. 1960 - Mar. 1973
Aug. 1973 199 p refs Supersedes AD-704450
(AD-765475; AD-704450; DDC-TAS-73-56) Avail: NTIS CSCL 13/8

The bibliography is a collection of references on Vapor Plating pertaining to metal films, thin films, semiconducting films, metal coatings, crystal growth, refractory materials, process development, manufacturing methods, and research and development of the vapor plating techniques. Corporate Author-Monitoring Agency, Subject, Title, and Personal Author Indexes are included. Author (GRA)

N74-10484# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
DYNAMIC TEST OF GEARS MANUFACTURED BY ADVANCED FORGING TECHNIQUES Final Report
Harold K. Frint May 1973 63 p refs
(Contract DAAJ02-69-C-0060; DA Proj. 1G1-62207-AA-72) (AD-765491; SER-50680; USAAMRDL-TR-73-13) Avail: NTIS CSCL 13/9

The purpose of the project was to evaluate the dynamic fatigue strength of spur gear teeth produced by advanced forging techniques in comparison to those manufactured by conventional forging methods. All of the advanced forging processes evaluated in this program used high-energy-rate forging techniques which produced gear blanks with integrally forged teeth. The die design and type of press were different for the three advanced processes; however, they produced similar as-forged gear blanks except for some variations in flash formation. On the basis of the results obtained, the best advanced forging process shows and advantage over the conventional forging process which is in the order of 5 to 8 percent. (Modified author abstract) GRA

N74-10485# George Washington Univ., Washington, D.C. School of Engineering Applied Science.
SOME CONTRIBUTIONS TO THE STOCHASTIC CHARACTERIZATION OF WEAR
Andrew L. Haines and Nozer D. Singpurwalla 10 Jul. 1973 39 p refs
(Contract N00014-67-A-0214-0001; Proj. 347-020)
(AD-765719; Serial-T-288) Avail: NTIS CSCL 14/4

In the paper the authors present some properties of the class of life distributions characterized by the fact that their mean residual life is decreasing (increasing) in time. Bounds are given on the survival function of this class and results are summarized on class closures under mixtures, convolutions, and the formation of coherent structures. Introduced next is a new class, characterized by the fact that some percentile of its residual life decreases (increases) in time. This class will be abbreviated as the DPL (IPL) class. The authors investigate the implications between this class and those that are known in the literature. In addition to this, bounds are obtained on the survival function of the DPL (IPL) class and the results are summarized on the closure properties mentioned above. A family of distributions

are given which are characterized by the fact that for some percentile of their residual lives, the distributions are both IPL and DPL. It is noted that this family is not the exponential family. (Modified author abstract) GRA

N74-10486# Mechanical Technology, Inc., Latham, N.Y.
INVESTIGATION OF ROTOR DYNAMIC AND HIGH SPEED BEARING TECHNOLOGY FOR A 3 KW TURBO-ALTERNATOR Interim Report, 16 Sep. 1971 - 31 Dec. 1972
Warren D. Waldron Feb. 1973 108 p refs
(Contract DAAK02-72-C-0043)
(AD-765501; MTI-73TR11) Avail: NTIS CSCL 13/9

The report presents the initial results of an analytical and test rig investigation to identify any limitations or problems relative to high-speed bearings and rotor dynamics for future, very small (3KW) turboalternators. The results reported cover the following three tasks: An analytical effort to select a representative 3KW turboalternator configuration in terms of the major aerodynamic and electrical rotating components; An analytical effort to determine shaft-assembly/bearing-system arrangements applicable to the 3KW turboalternator configuration; A detailed design and initial test of a full scale test rig representative of the optimum shaft-assembly/bearing-system arrangement for the 3KW turboalternator. (Modified author abstract) GRA

N74-10487# Oklahoma State Univ., Stillwater. Fluid Power Research Center.
HYDRAULIC CYLINDER AND SEAL SPECIFICATION STUDY Annual Report, Section 1, 1 Oct. 1970 - 1 Sep. 1972
Sep. 1972 130 p
(Contracts DAAK02-71-C-0074; DAAK02-72-C-0172)
(AD-757722; OSU-FPRC-2M1) Avail: NTIS CSCL 13/7

The purpose of the OSU-MERDC hydraulic specification program is to develop industrially acceptable test procedures and requirement specifications relative to the performance of hydraulic components and systems to facilitate the military's buy commercial approach. Although the program has been aimed toward components and systems for future 3000 psi operating pressure levels, it was intended that the test procedures be applicable to any pressure level. This report presents a detailed account of the experimental verification part of the hydraulic cylinder and seal studies. It relates the problems encountered as well as the solutions, as reflected in the revised test procedures and specifications. The three components considered in this report are hydraulic cylinders, hydraulic pressure seals, and wiper seals (exclusion devices). Author (GRA)

N74-10488# Watervliet Arsenal, N.Y.
RELIABILITY DATA ANALYSIS MODEL
R. Racicot Jul. 1973 91 p refs
(AD-765481; R-WV-T-6-22-73) Avail: NTIS CSCL 14/4

A computer model has been prepared to assist in the analysis of reliability test data. Essentially, the model computes point estimates and confidence limits for mission reliability of components, subsystems, and systems from component failure data. The main features of the model are: Performs goodness-of-fit tests to determine the best fit probability distribution of component failure times; Computes maximum likelihood estimates of distribution parameters; Computes point estimates of reliability for the renewal nonconstant failure rate case; Computes lower confidence limits for component, subsystem, and system reliability for the constant failure rate case. Author (GRA)

N74-10489# Army Foreign Science and Technology Center, Charlottesville, Va.
NORMAL STRESSES ON THE FORE EDGE OF A CUTTING TOOL
I. I. Mansurov 21 Mar. 1973 8 p ref Transl. into ENGLISH from Tr. Mekhan. Inst., Izhevsk (USSR)
(AD-765846; FSTC-HT-23-1739-72) Avail: NTIS CSCL 13/9

The report discusses a mathematical analysis of the title problem. GRA

N74-10490# Office of Naval Research, London (England).
THE 6TH INTERNATIONAL CONFERENCE ON FLUID SEALING
David F. Dyer 18 Jul. 1973 11 p refs Conf. held at Munich, 27 Feb. - 2 Mar. 1973
(AD-765710; ONRL-C-15-73) Avail: NTIS CSCL 11/1

A very brief survey of the 6th International Conference on Fluid Sealing is presented. Particular reference is made to papers concerning the following topics: High Temperature Seal Development; Seals for Marine Application; The Elastomer contact seal and pressure build-up in seals. Suggestions as to current problems in seal design as well as approaches to their solution are given. (Modified author abstract) GRA

N74-10491# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
HYDROFLUIDIC SERVOACTUATOR DEVELOPMENT Final Technical Report, 18 Nov. 1971 - 31 Oct. 1972
Holger C. Kent and J. Robert Sjolund May 1973 58 p
(Contract DAAJ02-72-C-0017)
(AD-766308; GAPD-W0510-FR; USAAMRDL-TR-73-12) Avail: NTIS CSCL 13/7

The report covers the design and development of a hydrofluidic servoactuator. The objective of the program was to demonstrate the feasibility of a servoactuator utilizing a hydrofluidic amplifier cascade input stage which replaces the bellows-flapper-nozzle of a conventional servovalve, a spring-centered spool valve, a fluid feedback transducer, and an actuator. The servoactuator was designed to utilize U.S. Army aircraft hydraulic fluid, meeting specifications of MIL-H-5606, and to meet the performance of a UH-1 helicopter. Author (GRA)

N74-10492# Defense Documentation Center, Alexandria, Va.
ELECTRODEPOSITION Bibliography Report, Dec. 1955 - Aug. 1972
Mar. 1973 274 p refs
(AD-756750; DDC-TAS-73-12) Avail: NTIS CSCL 11/3

The bibliography contains unclassified and unlimited references to reports on methods of coating on metals and composites by Electrodeposition. Author (GRA)

N74-10493# Defense Documentation Center, Alexandria, Va.
ELECTROPLATING Bibliography Report, Dec. 1955 - May 1972
Mar. 1973 152 p refs
(AD-756800; DDC-TAS-73-16) Avail: NTIS CSCL 11/3

The bibliography contains unclassified and unlimited references to reports on the process of coating metals and composites by the Electroplating technique. Author (GRA)

N74-10494# Denver Research Inst., Colo.
CENTER FOR HIGH ENERGY FORMING Semiannual Technical Report, 1 Jan. - 30 Jun. 1973
Henry E. Otto Jul. 1973 33 p refs
(Contract DAAG46-72-C-0130; ARPA Order 720)
(AD-766213; AMMRC-CTR-73-23; SATR-2) Avail: NTIS CSCL 13/8

The report summarizes work at the Center for High Energy Forming include: A metallurgical investigation of explosion welded copper-nickel composites; Determination of the optimum parameters for explosion welding A515 steel; Analysis and design of an explosion cladding facility; Free forming steel domes with D/t ratios of 56 and greater; the mechanics of energy transfer from underwater explosions; The explosive free-forming of arbitrary shapes from thin metal sheets; Stress corrosion cracking behavior of explosively deformed austenitic stainless steel; Explosive thermomechanical processing of beta III Titanium alloy; Explosive compaction of nickel base superalloy powders; Engineering economics of the explosive forming manufacturing facilities. (Modified author abstract) GRA

N74-10495# Bendix Research Labs., Southfield, Mich.
BRAKE EMISSIONS: EMISSION MEASUREMENTS FROM BRAKE AND CLUTCH LININGS FROM SELECTED MOBILE SOURCES Final Report
M. G. Jacko and R. T. DuCharme Mar. 1973 325 p refs
(Contract EPA-68-04-0020)
(PB-222372/5; APTD-1557) Avail: NTIS HC $7.00 CSCL 13B

In order to define the extent of gas and particulate emissions from automotive brakes (and clutches), a combination separation and storage collection system was devised. Unique emissions

collectors for both disc and drum brakes and for a clutch were conceived, designed, and built as the main embodiment of this instrumentation. The brake emissions generated were removed from the various collectors and mass balances were performed. The particulates were processed and analyzed by a combination of optical and electron microscopy to ascertain the asbestos content and the asbestos particle size distribution in the wear debris. Comparisons of emissions from new and used friction materials, disc and drum brakes, and original equipment and aftermarket materials were made. Finally, an estimate was made of the total emission of asbestos by all of the vehicles in the country. (Modified author abstract) GRA

N74-10496# Army Electronics Command, Fort Monmouth, N.J.
A NOVEL MONOLITHIC SILICON VAPOR CHEMICAL PROGRESS: SILICON-NITRIC OXIDE-HYDROGEN FLUORIDE
William B. Glendinning, Wellington B. Pharo, and David W. Yarbrough (Tenn. Technol. Univ.) Dec. 1972 46 p refs
(DA Proj. 1S6-62703-A-440)
(AD-756432; ECOM-4061) Avail: NTIS CSCL 09/1

A novel vapor chemical process was developed and evaluated for its application to silicon (Si) monolithic integrated circuit (MIC) technology. The low temperature (25 C) process was derived from the reaction of hydrogen fluoride (HF) and nitrogen oxide (NO and NO2) with Si. The Si oxide films, thus grown, can be used as drop out impurity diffusion-mask materials in fabricating n-p junction diodes. The surface electronic stabilizing feature of the film is evaluated in terms of recombination-generation reverse bias currents and in terms of trapped insulator charge and interface states. Electrical voltage-current characteristics of diodes compare favorably with the analogous thermal oxide stabilized type. Because the oxide growth mechanism itself is photosensitive, the chemical reaction has potential use in relation to photoresistless IC processing. Finally, from a device reliability point-of-view, Auger and scanning electron microscopic analysis demonstrate the new process as an ultrasensitive chemical diagnostic technique for delineating Si-surface contamination.
Author (GRA)

N74-10292* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
SPHERE FORMING IN ZERO GRAVITY
W. Audin, D. Larson, Jr., G. Busch, and G. I. Geschwind *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 893-907 refs (For availability see N74-10232 01-11) CSCL 13H

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State

N74-10497 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRON BEAM HOLOGRAPHY
A. Tonomura and H. Watanabe Jul. 1973 6 p refs Transl. into ENGLISH from Butsuri (Japan), v. 23, no. 9, 1968 p 683-684
(NLL-RTS-7870) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50; 2 NLL photocopy coupons

Electron beam holography is described along with experiments on the formation of electron beam holograms. A summary of the advantages and effects of electron beam holography is included. K.M.M.

N74-10498*# Stanford Univ., Calif. Microwave Lab.
INVESTIGATION OF LASER DYNAMICS, MODULATION AND CONTROL BY MEANS OF INTRA-CAVITY TIME VARYING PERTURBATION Semiannual Status Report, 1 Feb. - 31 Jul. 1973
S. E. Harris Jul. 1973 39 p refs
(Grant NGL-05-020-103)
(NASA-CR-136024; SASR-19; SU-ML-2192) Avail: NTIS HC $4.00 CSCL 20E

Work continued on a number of projects aimed at the generation of tunable visible, infrared, and ultraviolet light; and on the control of this light by means of novel mode-locking and modulation techniques. Progress is summarized for the following projects: (1) the transient modelocking of the Nd:YAG laser and application of short optical pulses; (2) studies of the sodium-xenon excimer laser; (3) development of techniques for vacuum ultraviolet holography; and (4) studies of multiple photon pumped xenon and argon excimer lasers. Author

N74-10499*# Old Dominion Univ. Research Foundation, Norfolk, Va.
INVESTIGATION OF LASER HOLOGRAPHIC INTERFEROMETRIC TECHNIQUES FOR STRUCTURE INSPECTION
William P. Chu Oct. 1973 47 p refs
(Grant NGR-47-003-069)
(NASA-CR-132344) Avail: NTIS HC $4.50 CSCL 20E

The application of laser holographic interferometric techniques for nondestructive inspection of material structures commonly used in aerospace works is investigated. Two types of structures, composite plate and solid fuel rocket engine motor casing, were examined. In conducting the experiments, both CW HeNe gas lasers and Q-switched ruby lasers were used as light sources for holographic recording setups. Different stressing schemes were investigated as to their effectiveness in generating maximum deformation at regions of structural weakness such as flaws and disbonds. Experimental results on stressing schemes such as thermal stressing, pressurized stressing, transducer excitation, and mechanical impact are presented and evaluated. Author

N74-10500*# New York Univ., N.Y. Dept. of Meteorology and Oceanography.
LASER RADAR STUDIES: A STUDY OF THE FEASIBILITY OF REMOTE MEASUREMENT OF ATMOSPHERIC DENSITY AND TURBIDITY BY MEANS OF ROTATIONAL RAMAN SCATTERING OF LASER LIGHT Final Report
Nathan Reiss and Richard M. Schotland Jul. 1973 200 p refs
(Contract NAS5-21666)
(NASA-CR-132816) Avail: NTIS HC $12.00 CSCL 20E

A remote sensing technique is described which utilizes elastic scattering and rotational Raman scattering of laser light in the atmosphere to obtain soundings of turbidity, transmissivity and density. A scheme is devised whereby, through selective weighting of the rotational Raman lines, the effect of atmospheric temperature structure may be eliminated. The close spectral proximity of the elastic and Raman-scattered signals, combined with the fact that the Raman scattering is quite weak, produces special requirements for the spectroscopic and light-gathering components of a rotational Raman laser radar system. These requirements are investigated. A computation of typical signal-to-noise ratios is made. It is shown that daytime signal-to-noise ratios greater than 10 db are to be expected for observation heights of 5 km and below. For nighttime work, 10 db signal-to-noise ratios are achievable to altitudes as high as 15 km. Author

N74-10501*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BINARY SELECTABLE DETECTOR HOLDOFF CIRCUIT: DESIGN, TESTING, AND APPLICATION
K. A. Kadrmas 18 Sep. 1973 31 p refs
(NASA-TM-X-64785) Avail: NTIS HC $3.75 CSCL 20E

A very high speed switching circuit, part of a laser radar data acquisition system, has been designed and tested. The primary function of this circuit was to provide computer controlled switching of photodiode detector preamplifier power supply voltages, typically less than plus or minus 20 volts, in approximately 10 nanoseconds. Thus, in actual use, detector and/or detector preamplifier damage can be avoided as a result of sudden extremely large values of backscattered radiation being detected, such as might be due to short range, very thin atmospheric dust layers. Switching of the power supply voltages was chosen over direct switching the photodiode detector input to the preamplifier, based on system noise considerations. Also, the circuit provides a synchronized trigger pulse output for triggering devices such as the Biomation Model 8100 100 MHz analog to digital converter. Author

N74-10502*# Holobeam, Inc., Paramus, N.J.
LAMP PUMPED Nd:YAG LASER. SPACE-QUALIFIABLE Nd:YAG LASER FOR OPTICAL COMMUNICATIONS Final Report, 15 Jun. 1971 - 21 Jul. 1972
Kevin B. Ward May 1973 113 p refs
(Contract NAS5-11461)
(NASA-CR-132821) Avail: NTIS HC $7.75 CSCL 20E

Results are given of a program concerned with the design, fabrication, and evaluation of alkali pump lamps for eventual use in a space qualified Nd:YAG laser system. The study included evaluation of 2mm through 6mm bore devices. Primary emphasis was placed upon the optimization of the 4mm bore lamp and later on the 6mm bore lamp. As part of this effort, reference was made to the Sylvania work concerned with the theoretical modeling of the Nd:YAG laser. With the knowledge gained, a projection of laser performance was made based upon realistic lamp parameters which should easily be achieved during following developmental efforts. Measurements were made on the lamp performance both in and out of the cavity configuration. One significant observation was that for a constant vapor pressure device, the spectral and fluorescent output did not vary for vacuum or argon environment. Therefore, the laser can be operated in an inert environment (eg. argon) with no degradation in output. Laser output of 3.26 watts at 430 watts input was obtained for an optimized 4mm bore lamp. Author

N74-10503*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE MINIMIZATION OF THE PRIME POWER CONSUMPTION OF A COUPLING-MODULATED GAS LASER TRANSMITTER
John J. Degnan Oct. 1973 40 p refs Submitted for publication
(NASA-TM-X-70505; X-524-73-312) Avail: NTIS HC $4.00 CSCL 20E

The prime power requirements of a coupling-modulated gas laser transmitter are presented. The latter consists of a gas discharge tube and electro-optic modulator inside a laser resonator. In performing the calculations, the laser discharge length and the modulator voltage are simultaneously varied so that the transmitted power remains constant. In this way, tradeoffs can be made between the prime power supplied individually to the discharge tube and to the modulator driver to obtain a transmitter configuration which minimizes the total prime power consumption. An analytical expression is derived which describes the effects of information bandwidth and transmitter output power on the prime power requirements. Specific numerical results are obtained for a CO2 laser transmitter based on presently available experimental data. Author

N74-10504# Physisch Laboratorium RVO-TNO, s-Gravenhage (Netherlands).
TRANSMISSION OF FOCUSSED LASER BEAMS THROUGH THE ATMOSPHERE
T. Bakker and J. Vriend Apr. 1973 20 p refs
(PH.L.1973.17) Avail: NTIS HC $3.00

The influences of turbulences in the atmosphere on the size of the spot of a focussed laser beam are investigated. Results of measurements performed with a helium-neon laser under various atmospheric conditions are reported. The measured data are compared with those published in the literature. Author

N74-10505*# Arizona Univ., Tucson. Optical Sciences Center.
ELECTROMAGNETIC DIFFRACTION EFFICIENCIES FOR PLANE REFLECTION DIFFRACTION GRATINGS Final Report, 1972 - 1973
A. S. Marathay and T. E. Shrode Jul. 1973 34 p refs
(Contract NAS5-11456)
(NASA-CR-132854) Avail: NTIS HC $3.75 CSCL 20E

Results are presented of research activities on holographic grating research. A large portion of this work was performed using rigorous vector diffraction theory, therefore, the necessary theory has been included in this report. The diffraction efficiency studies were continued using programs based on a rigorous theory. The simultaneous occurrence of high diffraction efficiencies and the phenomenon of double Wood's anomalies is demonstrated along with a graphic method for determining the necessary grating parameters. Also, an analytical solution for a grating profile that is perfectly blazed is obtained. The performance of the perfectly blazed grating profile is shown to be significantly better than grating profiles previously studied. Finally, a proposed method is described for the analysis of coarse echelle gratings using rigorous vector diffraction that is currently being developed. Author

N74-10506*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A HIGH-PRESSURE CARBON DIOXIDE GASDYNAMIC LASER
Donald M. Kuehn Washington Nov. 1973 21 p refs
(NASA-TN-D-7471; A-4993) Avail: NTIS HC $2.75 CSCL 20E

A carbon dioxide gasdynamic laser was operated over a range of reservoir pressure and temperature, test-gas mixture, and nozzle geometry. A significant result is the dominant influence of nozzle geometry on laser power at high pressure. High reservoir pressure can be effectively utilized to increase laser power if nozzle geometry is chosen to efficiently freeze the test gas. Maximum power density increased from 3.3 W/cu cm of optical cavity volume for an inefficient nozzle to 83.4 W/cu cm at 115 atm for a more efficient nozzle. Variation in the composition of the test gas also caused large changes in laser power output. Most notable is the influence of the catalyst (helium or water vapor) that was used to depopulate the lower vibrational state of the carbon dioxide. Water caused an extreme deterioration of laser power at high pressure (100 atm), whereas, at low pressure the laser for the two catalysts approached similar values. It appears that at high pressure the depopulation of the upper laser level of the carbon dioxide by the water predominates over the lower state depopulation, thus destroying the inversion. Author

N74-10507# Radio Corp. of America, Princeton, N.J.
EFFECTS OF TURBULENCE INSTABILITIES ON LASER PROPAGATION. PHASE 2 Final Report, Apr. 1973 - 15 Aug. 1973
David A. DeWolf Aug. 1973 45 p refs
(Contract F30602-72-C-0486; ARPA Order 1279)
(AD-766137; PRRL-73-CR-47) Avail: NTIS CSCL 20/6

The report on the behavior of laser beams in turbulent air extends results summarized in a previous report, AD-763109. It is shown that amplitude scintillation is unimportant in focused beams and is dominant in collimated and diverging beams. The limitations of an existing numerical procedure for computing these are investigated. Intermittency of turbulence is redefined in terms of large-scale variations in the refractive-index structure constant and the dependence upon averaging time is determined. It is concluded that intermittency is essentially an extra randomness during operation of the laser for short periods (of several minutes or less). Significant fluctuation rates are defined for angle of arrival, phase, and amplitude. They differ greatly. Author (GRA)

N74-10508# Stanford Research Inst., Menlo Park, Calif.
STUDIES OF E-BEAM PUMPED MOLECULAR LASERS Semiannual Technical Report, 1 Jan. - 30 Jun. 1973
Donald J. Eckstrom, Robert M. Hill, Robert A. Gutcheck, David L. Huestis, and Donald C. Lorents 31 Jul. 1973 79 p refs
(Contract N00014-72-C-0478; ARPA Order 1807; SRI Proj. PYU-1925)
(AD-766158; SRI-MP73-1; SATR-2) Avail: NTIS CSCL 07/4

The report covers experimental and theoretical work on the feasibility of attaining laser action in high pressure gases excited by electron beam pulses. The radiative decay of Hg2 dimers has been measured as well as the existence of net absorption of excited Hg2. It is concluded that direct laser action by Hg2 is unlikely. A reappraisal of the Hg2 states is presented. Initial experimental studies of Ar - N2 mixtures are presented that show general agreement with model calculations and the ability to create large useable populations of metastable excited N2. Author (GRA)

N74-10509# Naval Postgraduate School, Monterey, Calif. Dept. of Physics and Chemistry.
LASER BEAM SCINTILLATION IN THE MARINE BOUNDARY LAYER M.S. Thesis
Brian Christian Haagensen Jun. 1973 110 p refs

(AD-765676) Avail: NTIS CSCL 20/6

Intensity scintillation in a laser beam at 0.63 micrometers in the marine boundary layer has been studied over a 4.3 kilometer horizontal path across Monterey Bay and also from shore to ship at San Nicolas Island. Optical and micrometeorological measurements of the refractive index structure constant, C(N), agree to approximately one standard deviation giving values in the range of 2.0 x 10 to the minus 8th power to 5.0 x 10 to the minus 8th power (meters) to the minus 1/3 power. Optical and meteorological data correlation improved as mean wind speed increased. Evidence was found to support the reported existence of a saturation region for the laser beam logarithmic amplitude variance. Author (GRA)

N74-10510# Naval Postgraduate School, Monterey, Calif. Dept. of Physics and Chemistry.

INVESTIGATION AND OPERATION OF A CARBON DIOXIDE TEA LASER M.S. Thesis

William Frederick Bassett Jun. 1973 101 p refs

(AD-765698) Avail: NTIS CSCL 20/5

Lasing has been achieved at 10.6 microns using a double discharge CO2 TEA configuration. The double discharge configuration utilizes three electrodes. The third, trigger, electrode in this particular device consists of glass encapsulated nichrome wires. The third electrode is responsible for corona formation--the dominant preionization mechanism. A parametric analysis of the discharge was conducted. The discharge was found to be dependent on the gas mixture, the gas flow rate, the voltage rise time and the voltage pulse shape. It was found that satisfactory discharge operation leading to lasing was limited to a very small region of parameter space having a helium percentage of not less than 90% (with 5% CO2 and 5% N2), and a rise time on the order of 3 microsec. Lasing action yielded 5 joules/pulse. The energy was limited by the optical components used, and it is felt that the energy can be increased to approximately 19 joules/pulse using different circuit parameters in conjunction with improved optical components. Author

N74-10511# Northrop Corp., Hawthorne, Calif. Research and Technology Center.

IMPROVED MODE PROPERTIES OF UNSTABLE RESONATORS WITH TAPERED REFLECTIVITY MIRRORS AND SHAPED APERTURES

G. L. McAllister, W. H. Steier, and W. B. Lacina Aug. 1973 45 p refs

(Contract N00014-72-C-0043; ARPA Order 1806)

(AD-765764; NRTC-73-33R) Avail: NTIS CSCL 20/5

The use of tapered reflectivity mirrors and shaped apertures in unstable resonators is shown to be an effective method for improving the mode properties. Mode intensity and phase profiles are smoothed and the mode discrimination ratio is increased. Results are presented illustrating the importance of diffracted waves from sharp mirror edges in determining these mode properties. A simple expression for estimating the diffractive contribution is given and is used to determine optimum mirror designs. Shaped mirrors and mirrors having amplitude and phase reflectivity tapers are studied. The concept of equivalent Fresnel zones is used to gain physical insight into the mode properties. Author (GRA)

N74-10512# Frankford Arsenal, Philadelphia, Pa.

LASER BEAM DIVERGENCE AND FAR FIELD MEASUREMENTS

Gerald C. Holst May 1973 29 p refs

(DA Proj. 1T0-61102-A-31C; DA Proj. 3A0-62110-A-821; DA Proj. 3A0-61102-B-71P)

(AD-765482; FA-R-2075) Avail: NTIS CSCL 20/5

Accurate determination of beam divergence and far field intensity distribution require careful determination that the far field is being examined. Although the far field exists at a sufficiently large distance from the laser, it is easier to perform measurements in the focal plane of a lens which is equivalent to an infinite distance. The beam divergence is specified as that angle which contains a certain percentage of the total power in the far field. Since this is a plane angle, confusion arises between the intensity distribution (w/sq cm) and the power distribution (watts). Several methods are available for determining the divergence from the far field pattern. These methods are experimentally verified with a He-Ne laser. Construction of a unique portable two lens far field camera is discussed. Author (GRA)

N74-10513# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.

BLEACHABLE ABSORBER LASER AMPLIFIER AND DETECTOR (BALAD) Interim Technical Report, Jan. - Jul. 1972

James T. LaTourrette and John Wilson Griffiss AFB, N. Y. RADC May 1973 55 p refs

(Contract F30602-72-C-0245; ARPA Order 1279)

(AD-765842; PIBEP-73-127; RADC-TR-73-172) Avail: NTIS CSCL 17/5

The report describes the continued development of the wide-angle, low noise BALAD receiver (Bleachable Absorber Laser Amplifier and Detector). The spatial and frequency resolution of a SF6 saturable absorber in a 10.6 micrometer BALAD configuration has been measured. The experimental results agree with the theoretical predictions. The components of a Xenon-Xenon 3.5 micrometer BALAD system have been assembled, and experimental tests have been initiated. The theoretical analysis of the propagation of coherent optical pulses in resonant media has been extended to three dimensions, but only preliminary results have been obtained. Author (GRA)

N74-10514# ARO, Inc., Arnold Air Force Station, Tenn.

HOLOGRAPHY IN DUST EROSION FACILITIES Final Report, Jul. 1970 - Jun. 1972

J. D. Trolinger and R. A. Belz AEDC Sep. 1973 72 p refs

(AD-766420; ARO-OMD-TR-72-168; AEDC-TR-73-160) Avail: NTIS CSCL 16/3

Extensive application of holographic techniques has been made in the ground test facilities at the Arnold Engineering Development Center (AEDC) for particle-field analysis and flow diagnostics. The instrumentation requirements of dust erosion facilities include a dynamic evaluation of the dust cloud, including size, number density, velocity, and distribution of dust particles. Holography has provided a unique method of performing such an evaluation. The system developed at AEDC and currently in routine use is discussed in detail. Design criteria and system capability are analyzed. It is shown that the holography system provides data which cannot be obtained with other existing instrumentation. Author (GRA)

N74-10515# Bendix Research Labs., Southfield, [illegible]

FEASIBILITY STUDY OF EXOELECTRON IMA[illegible] AS AN NDT METHOD FOR LASER SURFACE DAMAGE OF NONLINEAR OPTICAL MATERIALS AND LASER GLASS Semiannual Technical Report

Peter F. Braunlich and John P. Carrico Mar. 1973 49 p refs

(Contract F19628-73-C-0032; ARPA Order 2042; BRL Proj. 2322)

(AD-766244; RLD-6557; AFCRL-TR-73-0068; SATR-1) Avail: NTIS CSCL 20/5

The report presents the results of a 6-month effort on the development of an NDT method to predict surface damage on dielectric materials used in high power laser systems (such as those used in communication and ordnance). The research in this program has three objectives: investigating exoelectron (EE) properties of laser optical materials after exposure to ionizing or laser radiation; correlating exoelectron images with laser surface damage characteristics; and determining the feasibility of exoelectron surface imaging as an NDT method of predicting the laser surface damage threshold. Results to date indicate that EE emission from laser glass is too weak and irreproducible to be of value. Experiments on pyroelectric LiNbO3 led to the discovery of thermally stimulated field emission. This phenomenon is presently being attributed to a high electric field on the surface of a LiNbO3 resulting from a small change in the temperature of the material. Author (GRA)

N74-10516# Aerospace Corp., El Segundo, Calif.

FLOW DIAGNOSTIC MEASUREMENTS IN THE MEDIUM OF A CONTINUOUS WAVE HF CHEMICAL LASER Technical Report, Dec. 1971 - Feb. 1972

Robert L. Varwig and Munson A. Kwok 28 Aug. 1973 32 p refs

(Contract F04701-73-C-0074)

(AD-766416; TR-0074(4534)-1; SAMSO-TR-73-293) Avail:

NTIS CSCL 20/5

Knowledge of the local flow dynamic properties in the flow field of a continuous diffusion type chemical laser is required because the index of refraction of the lasing medium is a function of the fluid dynamic properties. Satisfactory techniques for obtaining pressure, temperature, pitot pressure, and shock angle in a reacting fluorine-hydrogen flow are described. The application of the measurements to the definition of the flow properties is presented. Author (GRA)

N74-10517# ARO, Inc., Arnold Air Force Station, Tenn.
LASER VELOCIMETRY DATA PROCESSING Final Report, 1969-1973
H. T. Kalb, D. B. Brayton, and J. A. McClure AEDC Sep. 1973 49 p refs
(ARO Proj. BF319-12YA)
(AD-766418; ARO-OMD-TR-73-62; AEDC-TR-73-116) Avail: NTIS CSCL 20/6

The development of instrumentation for capture and processing of low signal density frequency burst data produced by a laser velocimeter is described. This signal type typically occurs at high flow rates and/or with no artificial seeding. The extension of the instrument application into poor signal-to-noise areas is described. Author (GRA)

N74-10518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHOCK WAVES OCCURRING AS A RESULT OF LASER RADIATION ON TRANSPARENT BODIES
I. I. Ashmarin, Yu. A. Bikovskii, V. A. Gripin, V. F. Elesin, A. I. Larkin, and I. P. Sipaylo 5 Apr. 1973 9 p refs Transl. into ENGLISH from Sb. Statei Kvantovaya Elektron. (USSR), v. 1, no. 6, 1971 p 126-128
(AD-759867; FTD-HT-23-239-73) Avail: NTIS CSCL 20/6

The object of this study is the dynamic processes occurring when the radiation of a ruby laser is focused on a glass. When producing radiation with a density of about 10 to the 10th power w/sq cm in the focal volume of the lens, failure takes place in a transparent substance. This failure appears as the center of a shock wave. GRA

N74-10519# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF NONLINEAR PROPAGATION AND CHIRPING OF SHORT CO2 LASER PULSES Annual Summary Report, 1 Apr. 1972 - 31 Mar. 1973
Paul J. Berger, Carl M. Ferrar, and David C. Smith 30 Apr. 1973 76 p refs
(Contract N00014-69-C-0308; NR Proj. 016-204)
(AD-760011; UARL-M920832-6) Avail: NTIS CSCL 20/5

Research is described on an experimental program to generate short pulses at the 10.6 micrometers wavelength, to study the propagation and interaction of these pulses with amplifying and absorbing media, and to investigate flowing metal vapor lasers as sources of radiation in the blue-green portion of the spectrum. The selection of a single pulse from a train of mode-locked CO2 laser pulses based on the attenuation and reflection of a gas breakdown has been explored. Work with several low temperature metal vapor lasers, led to the practical design for copper vapor laser operation using fast closed-cycle transverse vapor flow. (Author modified abstract) GRA

N74-10520# GTE Labs., Inc., Waltham, Mass.
TUNABLE CW DYE LASER Final Technical Report, 1 Jan. - 30 Apr. 1973
A. Lempicki, L. Riseberg, and H. Samelson Jul. 1973 77 p refs
(Contract DAHC04-71-C-0012; DA Proj. 200-61102-B-11B)
(AD-766277; TR-73-840.2; AROD-9422-5-P) Avail: NTIS CSCL 20/5

The report describes the single-frequency output of the dye laser and a description is given of a spectroscopic method for measurement of the dimer equilibrium constant in Rhodamine-detergent solutions. A rough comparison of Rhodamine 6 G and a new dye of the Rhodamine family and effects encountered in ethanolic solution is discussed and the application of the laser to line-narrowing experiments on Nd in glass and POC l3 is described. A general treatment of the molecular anisotropy effects as they may influence the working of a dye laser is presented. An Appendix (by R. Walters) describes the synthesis of a xanthene dye used for comparison with Rhodamine 6 G. (Modified author abstract) GRA

N74-10447 Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF A LASER BEAM ON IMMOBILE OR MOBILE TARGETS [EINFLUSS EINES LASERSTRAHLES AUF FESTSTEHENDE ODER BEWEGTE ZIELE]
H. Fagot *In its* Papers on Ballistics and Phys. of Transience 1973 p 213-224 refs In GERMAN; ENGLISH summary Sponsored by Direc. des Rech. et Moyens d'Essais (For availability see N74-10435 01-14)

N74-10448 Institut Franco-Allemand de Recherches, St. Louis (France).
LASER INDUCED INITIATION OF EXPLOSIVES [UEBER DIE INITIIERUNG VON SPRENGSTOFFEN DURCH LASER-STRAHLUNG]
K. Vollrath, G. Gulitz, M. Hugenschmidt, and A. Hirth *In its* Papers on Ballistics and Phys. of Transience 1973 p 225-251 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N74-10521* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF HEAT TREATING A FORMED POWDER PRODUCT MATERIAL Patent
John C. Freche, William J. Waters, and Richard L. Ashbrook, inventors (to NASA) Issued 16 Oct. 1973 5 p Filed 28 Jun. 1972 Supersedes N72-28542 (10 - 19, p 2575) Continuation-in-part of US Patent Appl. SN-29917, filed 20 Apr. 1970
(NASA-Case-LEW-10805-3; US-Patent-3,765,958;
US-Patent-Appl-SN-266928; US-Patent-Class-148-126;
US-Patent-Class-29-420.5; US-Patent-Class-75-200;
US-Patent-Class-75-226; US-Patent-Appl-SN-29917) Avail: US Patent Office CSCL 11F

Heat treating a product material of prealloyed powders after shaping by superplastic deformation restores the ability of the material to resist deformation at high temperatures. Heat treating is accomplished by heating to a temperature between the solidus and liquidus with the application of isostatic pressure to close any voids. This pressure may be simultaneously applied while the material is at the heat treating temperature. The pressure may also be applied when the material cools to a temperature between that at which it is shaped and the solidus.
Official Gazette of the U.S. Patent Office

N74-10522 Illinois Inst. of Tech., Chicago.
EMBRITTLEMENT OF COMMERCIAL METAL ALLOYS BY SURFACE ACTIVE LIQUID METALS Ph.D. Thesis
Kent Lewis Johnson 1972 174 p
Avail: Univ. Microfilms Order No. 73-12211

The effects of strain rate and prior deformation on the liquid metal embrittlement behavior of commercial metal alloys were investigated. The embrittlement of these materials was observed as a loss in ductility and true fracture strength when tested in the presence of surface active liquid metals. This phenomenon was found to exist over a range of temperatures from below the melting point of the embrittling species in some cases, and up to a brittle-to-ductile recovery transition which occurred at an elevated temperature. The recovery temperature was found to be highly dependent upon the two test variables mentioned above. The effect of strain rate on the embrittlement behavior was studied on two different base metals - a 2024-T4 aluminum alloy (fcc) and a 4145 alloy steel (bcc) heat treated to a nominal tensile strength of 200 ksi. Dissert. Abstr.

N74-10523 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF AGEING AND CYCLIC STRESS ON THE RESIDUAL STRESS PRODUCED BY QUENCHING OF CARBON STEELS
S. Taira and R. Kitano Aug. 1973 17 p refs Transl. into ENGLISH from Zairyo (Kyoto) v. 61, no. 7, 1958 p 54-60 (552-558)
(NLL-RTS-8281) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.60 or 5 NLL photocopy coupons

The residual stresses produced by the heat treatment of carbon steel were divided into thermal and transformation residual stresses. The changes in each type of residual stress due to aging and cyclic stress were investigated and the following conclusions were drawn: (1) Thermal residual stress was reduced by application of cyclic stress; (2) when the material was allowed to stand, the transformation residual stress initially decreased rapidly with time, reached a minimum after about 7 days, increased again to a maximum after about 15 days, and then steadily declined, and (3) the above aging process was promoted both quantitatively and with respect to time when transformation residual stress was subject to a cyclic stress. Author

N74-10524 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF AGEING AND CYCLIC STRESS ON THE RESIDUAL STRESS PRODUCED BY CARBURIZATION AND QUENCHING OF STEEL
S. Taira and Y. Murakami Aug. 1973 19 p refs Transl. into ENGLISH from Zairyo (Kyoto), v. 62, no. 7, 1958 p 29-36 (591-599)
(NLL-RTS-8282) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.80 or 6 NLL photocopy coupons

Heat treatment by carburizing and quenching produces a simple thermal stress type of residual stress with surface compression and internal tension. Tempering after carburization effects a substantial decrease in residual stress. When carburized and quenched material is aged by allowing to stand at room temperature, the compressive residual stress in the surface first decreases for 7 days, increases to a high value after 15 days, and then declines steadily. The effect of cyclic stress on the compressive residual stress at the surface is to reduce the stress during the initial application. There is a marked difference in fatigue strength of carburized/quenched test pieces and as-carburized test pieces. Author

N74-10525 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TREATMENT CHARACTERISTICS OF TOOL STEELS QUENCHED FROM THE LIQUID STATE
Tohru Arai and Noboru Komatsu Aug. 1973 15 p refs Transl. into ENGLISH from Tetsu-to-Hagane (Tokyo), v. 58, no. 9, 1972 p 56-73 (1246-1263)
(NLL-RTS-8167) Avail: Natl. Lending Library, Boston Spa, Engl.: £3.30 or 11 NLL photocopy coupons

The relation between hardness and heat treatment conditions and the change in microstructure associated with heat treatment were investigated for hot-work die steel, cold-work die steel, and high speed steel quenched from the liquid. The following conclusions were drawn: (1) Cold-work die steels quenched from the liquid show adequate quenched hardness when quenched from a temperature of 100 to 150 C lower than the correct austenizing temperature for commercial forgings. (2) This is accounted for by ready dissolution in austenite of the fine carbide precipitate present in the cold-work die steels. (3) This effect was less marked in electron beam melted beads of high speed steel. (4) The effect was barely detectable in electron beam melted beads of hot-work die steel. (5) The difference in heat treatment characteristics of extruded bars and electron beam melted beads of high speed could not be readily explained by the difference in the size of the carbides. Author

N74-10526 Illinois Inst. of Tech., Chicago.
EFFECT OF PLASTIC DEFORMATION ON THE STRUCTURE AND TEMPERING BEHAVIOR OF A MEDIUM CARBON STEEL Ph.D. Thesis
Vinod Kumar Sharma 1972 211 p
Avail: Univ. Microfilms Order No. 73-12231

As-quenched martensitic 1045 steel bars were plastically deformed by drawing through a die. Dilatation, precision density, X-ray diffraction, and electron microscopy techniques were used to follow the changes during tempering to 1200 F as a function of deformation. The density of as-quench martensite was found to decrease with deformation. Plastic deformation of martensite transformed a part of the 2.9 of retained austenite to martensite and a large percentage of the density decrease could be accounted for by this transformation. Both, the (211) and the (222) X-ray diffraction lines of martensite were observed to sharpen with deformation. Maximum sharpening of the (211) lines occurred with less than one percent deformation, and with increasing deformation this sharpending was found to be slightly lower and almost independent of the degree of deformation.
Dissert. Abstr.

N74-10527*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
RESEARCH OF METAL SOLIDIFICATION IN ZERO-g STATE Final Report, 14 Jun. 1972 - 14 May 1973
William M. Aubin, Dave Larson, Jr., and Gary I. Geschwind Sep. 1973 74 p refs
(Contract NAS8-28604)
(NASA-CR-124464; RE-463) Avail: NTIS HC $5.75 CSCL 11F

An experiment test apparatus that allows metal melting and resolidification in the three seconds available during free fall in a drop tower was built and tested in the tower. Droplets (approximately 0.05 cm) of pure nickel and 1090 steel were prepared in this fashion. The apparatus, including instrumentation, is described. As part of the instrumentation, a method for measuring temperature-time histories of the free floating metal droplets was developed. Finally, a metallurgical analysis of the specimens prepared in the apparatus is presented. Author

N74-10528# Research Inst. of National Defence, Stockholm (Sweden).
AN ELECTROCHEMICAL METHOD FOR THE INVESTIGATION OF PITTING ON MILD STEEL
Per Atterby and Lars Schoen Mar. 1973 6 p refs Presented at the 5th Intern. Congr. on Metallic Corrosion, Tokyo, 21-27 May 1972
(FOA-1-B-1243-G1(G3)) Avail: NTIS HC $3.00

An electrochemical measurement cell was made for testing inhibitors of deposit corrosion and pitting. No current or potential is applied to the cell. The current produced by the cell is a direct measure of the localized attack. Corrosion current versus time was studied for six inhibitors, two water-soluble, and four oil-soluble. A tentative model of the action of corrosion inhibitors as reflected in the current/time diagram was formulated. The electrode potential of the cell was measured, and the anodic behavior of some inhibitors was correlated with the current/time results. By means of pilot tests in fuel tanks, a rough correlation was established between laboratory crevice cell data and the conditions in tanks. Author

N74-10529*# Kanner (Leo) Associates, Redwood City, Calif.
THE INTERNAL OXIDATION OF SILVER ALLOYS AT HIGH PRESSURES AND IN ATOMIC OXYGEN
D. Stoeckel and H. J. Grabke Washington NASA Nov. 1973 27 p refs Transl. into ENGLISH from Z. Metallk. (West Germany), v. 64, no. 4, 1973 p 286-295
(Contract NASw-2481)
(NASA-TT-F-15156) Avail: NTIS HC $3.50 CSCL 11F

The internal oxidation of silver alloys was studied at high pressures of molecular oxygen and also in atomic oxygen (at about 1 torr) from a microwave discharge. The parabolic relation for the penetration depth x of the oxidation zone was confirmed at pressures up to 10 atm in the temperature range 600 to 900 C for different alloying metals B = Cd, Al, In or Sn. In the microwave discharge the stationary oxygen concentration is established by the action of oxygen atoms incident on the silver surface and the reflection and recombination reactions. In the temperature range 400 to 700 C the rate constant corresponded to an effective oxygen pressure of 100 to 130 atm. At high oxygen pressure (real or effective) and high temperatures (> 700 C) the rate of internal oxidation was limited by the formation of an oxygen saturated melt or at lower temperatures

by the formation of silver oxide (450 C, 130 atm O2). The dependence of the melting point of silver on the pressure and temperature was derived from measurements of internal oxidation. Author

N74-10530*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LOW TEMPERATURE MECHANICAL PROPERTIES, FRACTOGRAPHIC AND METALLOGRAPHIC EVALUATION OF SEVERAL ALLOY STEELS
J. W. Montano Nov. 1973 87 p refs
(NASA-TM-X-64791) Avail: NTIS HC $6.50 CSCL 11D

The mechanical properties are presented of alloy steels, 4130, 4140, 4340, 6150, and 8740. Test specimens were manufactured from approximately 1.00 inch (2.54 cm) diameter bar stock which had been heat treated to two different hardness levels. The following mechanical tests were performed at temperatures of 80 F (+26.7 C), 0 F (-17.8 C), -100 F (-73 C), and -200 F (-129 C): (1) tensile test (Ultimate, yield, modulus, elongation, and reduction of area), (2) notched tensile test, (3) charpy V-notched impact test (impact energy), and (4) double shear strength test (ultimate and yield). The test data indicate excellent tensile strength, notched/unnotched tensile ratios, ductility, impact, and shear properties at all test temperatures, except at -200 F (-129 C) where the impact strength of the higher strength group of alloy steels, 4130 (Rc-37) and 4140 (Rc-44) decreased to approximately 9 ft. lbs. (12 joules) and 6 ft. lbs. (8 joules), respectively. Chemical, metallographic, and fractographic analyses were also performed to evaluate microstructure, microhardness and the effect of decrease in temperature on the ductile to brittle failure transition. Author

N74-10531# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
A PRELIMINARY INVESTIGATION OF THE BEHAVIOR OF HIGH PURITY COPPER IN HIGH MAGNETIC FIELDS Annual Report
F. R. Fickett Aug. 1973 73 p refs
(INCRA Proj. 186A)
Avail: NTIS HC $5.75

It is possible to create a desirable low resistivity at liquid helium temperature (4K) in pure copper by internal oxidation of impurities. The resistivity values achieved by this technique are below those found in even the purest commercial unoxidized copper by an order of magnitude. This lowered resistivity is important in applications of copper with superconductors, which operate in this temperature range. In fact grain boundaries provide the limit to the low temperature resistivity of polycrystalline copper rods which have undergone a long term oxygen anneal. It has been shown that it is possible to work internally oxidized bulk copper into wire while still maintaining a relatively low resistivity, if proper annealing techniques are used. A study of the process of internal oxidation by both electrical resistivity and by measurement of the low level magnetic properties of the impurity oxides by advanced techniques has increased understanding of the internal oxidation process. Author

N74-10532*# Metcut Research Associates, Inc., Cincinnati, Ohio.
CHARACTERIZATION OF THE MECHANICAL AND PHYSICAL PROPERTIES OF TD-Ni-Cr (Ni-20Cr-2Th02) ALLOY SHEET
L. J. Fritz, W. P. Koster, and R. E. Taylor [1973] 243 p refs (Contract NAS3-15558)
(NASA-CR-121221) Avail: NTIS HC $4.25 CSCL 11F

Sheets of TD-NiCr processed using techniques developed to produce uniform material were tested to supply mechanical and physical property data. Mechanical properties evaluated included tensile, modulus of elasticity, Poisson's Ratio, compression, creep-rupture, creep strength, bearing strength, shear strength, sharp notch and fatigue strength. Test temperatures covered the range from ambient to 1589K. Physical properties were also studied as a function of temperature. The physical properties measured were thermal conductivity, linear thermal expansion, specific heat, total hemispherical emittance, thermal diffusivity, and electrical conductivity. Author

N74-10533# Danish Research Center for Applied Electronics, Hoersholm.
QUALITY TESTING OF ELECTROPLATINGS: AN EVALUATION OF METHODS WITH EMPHASIS ON NOBLE METAL COATINGS FOR ELECTRICAL CONTACTS [KVALITETSBEDOMMELSE AF PLETTERINGER: EN UNDERSOGELSE AF MALEMETODER MED SAERLIG HENBLIK PA AEDELMETALBELAEGNINGER]
J. Bruun, S. T. Olesen, and P. Villien May 1973 115 p refs In DANISH; ENGLISH summary
(ECR-33) Avail: NTIS HC $7.75

The examinations conducted cover evaluation by microsectioning, radiometric measuring of layer thickness, scanning electron microscopy, corrosion testing, microhardness measurements, and adhesion tests. The production and collection of various test samples for the investigations made it possible also to draw a number of conclusions concerning the quality of different plating types, layer thicknesses, etc. Special emphasis was attached to the corrosion tests as the tests represent a new and rather promising method for the evaluation of the compactness of platings. In connection with this project a system for corrosion testing under controlled conditions was developed as well as a mass spectrometric measuring system intended for the control of test gases. Author

N74-10534# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
PHYSICAL METALLURGY BASIS FOR ACHIEVING 300-KSI STRENGTH IN TRANSAGE TITANIUM ALLOYS Final Report, 14 Oct. 1971 - 14 Aug. 1973
Frank A. Crossley Watertown, Mass. Army Mater. and Mech. Res. Center Aug. 1973 77 p refs
(Contract DAAG46-72-C-0016; DA Proj. 1T0-61101-A-91A)
(AD-766214; AMMRC-CTR-73-28) Avail: NTIS CSCL 11/6

Four martensitic titanium alloys: Transage 117 (Ti-2.5Al-14.5V-5Sn-7Zr), Transage 120 (Ti-3Al-15.5V-5Sn-10Zr), Transage 129 (Ti-2Al-11.5V-2Sn-11Zr) and Transage 134 (Ti-2.1Al-11.9V-2Sn-6Zr) were studied metallographically to determine their microstructural characteristics in beta-annealed and alpha-beta-annealed conditions. Thin-foil electron transmission was the principal metallographic means because the athermal martensite of these alloys is of the order of 10 A in thickness. The alloys undergo stress induced transformation in the annealed condition and possibly they experience this phenomenon in some age hardened conditions. The annealed conditions were starting states for thermomechanical treatment (TMT) studies for achieving 300-ksi strength. The strength goal seemed inherent in a number of the combinations of alloy and TMT schedule. Confirmation of the strength goal was not realized due to deficiencies in test specimens design and condition, and in the quality of machining. The fracture surfaces suggest that the materials have sufficient ductility to demonstrate the yield strength goal of 300-ksi. Author (GRA)

N74-10535# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
CORRELATION BETWEEN FATIGUE CRACK PROPAGATION AND LOW CYCLE FATIGUE PROPERTIES
Saurindranath Majumdar and Jo Dean Morrow Apr. 1973 38 p refs
(Grants DAHC15-72-G-0010; DAHC15-73-G-0007; ARPA Order 2169)
(AD-766138; T/AM-364; UILU-ENG-73-6010) Avail: NTIS CSCL 11/6

Fatigue crack propagation is treated as a succession of fatigue crack initiation events. The cyclic stress and strain experienced by each element ahead of the crack tip is computed by means of an elastic-plastic analysis of the crack tip region. The attendant cumulative fatigue damage is computed in terms of low cycle fatigue properties of the metal. Fatigue crack propagation data for eight steels are compared with predictions based on the analysis of low cycle fatigue properties and an analysis of the microstructural elements responsible for strengthening the steels. Author

N74-10536# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPERTIES OF ALLOY 4201 AT HIGHER TEMPERA-

TURES
A. T. Pronin 30 Aug. 1973 12 p refs Transl. into ENGLISH from the monograph "Novyi Konstruktsionny Material" (USSR), 1972. p 93-97
(AD-766968; FTD-HT-23-134-74) Avail: NTIS CSCL 11/6

The study concerns the properties of alloy 4201 (titanium with 32-35% molybdenum) and certain laws governing the change in its mechanical characteristics at higher temperatures. All studies were carried out on rod and sheet material. All sheet material samples were tested in the original state (vacuum annealing at 850, holding - one h, cooling in the furnace to 400, then in air). Forged rods were preannealed at 850 for one h and then air cooled. According to the data of microstructural analysis, before the tests the samples of alloy 4201 (from the rod and sheet) had a polyhedral structure of solid solution based on body-centered beta - titanium and molybdenum lattice. GRA

N74-10265* Battelle Columbus Labs., Ohio.
RESPONSE OF CANDIDATE METALLIC SPACE SHUTTLE MATERIALS TO SIMULATE REENTRY ENVIRONMENTS
I. M. Grinberg, E. S. Bartlett, and R. G. Luce *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 489-505 refs (For availability see N74-10232 01-11)
CSCL 11F

N74-10293* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
A NEW METHOD FOR DETERMINING THE ABSORPTIVITY AND EMISSIVITY OF METAL WIRES
A. Lorenz and H. P. Schmidt *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 909-918 (For availability see N74-10232 01-11)
CSCL 11F

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N74-10537 Washington Univ., St. Louis, Mo.
GASEOUS DIFFUSION AND PERMEATION IN FIBER-REINFORCED COMPOSITES Ph.D. Thesis
Bhoopinder Singh Mehta 1972 201 p
Avail: Univ. Microfilms Order No. 73-11819

The factors that influence permeation and diffusion in composites were investigated. Experimental data were obtained for both unfilled and filled cellulose acetate films. Two sets of experiments were designed. Solubility experiments were carried out to study the sorption and diffusion of water vapor while permeability experiments were carried out for diffusion and permeation of nitrogen and oxygen gases in unfilled and filled cellulose acetate films. Composite films were prepared for two extreme cases of filler permeability: impermeable filler and highly permeable filler. The mathematical treatment of the experimental data depended on the type of filler in the composite.
Dissert. Abstr

N74-10538 Washington Univ., St. Louis, Mo.
TRAJECTORIAL FIBER REINFORCEMENT OF COMPOSITE STRUCTURES Ph.D. Thesis
Adrianus Antonius Godefridus Cooper 1972 118 p
Avail: Univ. Microfilms Order No. 73-11811

The feasibility and the effectiveness of trajectorial fiber reinforcement were investigated. In a structure with trajectorial reinforcement, each individual fiber follows a unique path defined by the state of stress and/or strain induced by the prescribed boundary conditions. Trajectorial fiber reinforcement may be defined as: fiber reinforcement in which the principal material axes in any point are oriented with respect to the principal trajectories such that for given weight and given stress or strain the stiffness or the strength is maximum. The principal trajectories are those determined for an identical isotropic structure subjected to the same boundary conditions as the reinforced structure. Trajectorial reinforcement was found not to affect these principal trajectories. Adaptations of energy methods for isotropic structures were used to establish optimality conditions for trajectorial reinforcement. Dissert. Abstr.

N74-10539 National Lending Library for Science and Technology, Boston Spa (England).
SULPHIDE INCLUSIONS AND SOLIDIFICATION CRACKS
V. V. Podgaetskii Jul. 1973 43 p Transl. into ENGLISH of the book "Pori, Vklyuchennya i Trishchini v Zvarnikh Shvakh" Kiev, 1970
(NLL-RTS-7383) Avail: Natl. Lending Library, Boston Spa, Engl.: £4.20; 14 NLL Photocopy coupons

The influence of sulfides on inclusions, microstructure, and crack solidification of cast iron and steel during the molten phase is discussed. E.H.W.

N74-10540 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF THERMAL TREATMENT ON THE PROPERTIES OF TITANIUM DIOXIDE
Is. M. Okropiridze Jul. 1973 6 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk. Gruz. SSR (Georgian SSR), v. 68, no. 1, 1972 p 89-92
(NLL-RTS-8217) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50; 2 NLL photocopy coupons

Many metals and metallic oxides used as adsorbents and catalysts exist in the form of allotropic modifications or polymorphic varieties. Titanium dioxide is one of these oxides. X-ray diffraction and thermographic analyses of air-dried titanium dioxide gel were carried out, together with adsorption investigations, in order to obtain more detailed information concerning the properties of titanium dioxide gel. The gel was obtained by the action of ammonia on titanium tetrachloride in 6N hydrochloric acid.
Author

N74-10541# Aeronautical Research Inst. of Sweden, Stockholm.
ICE AND LANDING SURFACE DEMOULDING: REPLICA FABRICATION
Goeran Lundstroem 1973 13 p refs
(FAA-memo-90) Avail: NTIS HC $3.00

A method for using silicone rubber molding to obtain impressions of ice structures on wings and other aircraft surfaces is discussed. The limitations of the silicone material when used with deep and narrow grooved surfaces are described. The result of an experimental study to determine the effect of silicone oil on the performance of the rubber is presented. Author

N74-10542*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET LIGHT REFLECTIVE COATING Patent Application
John B. Schutt, inventor (to NASA) Filed 28 Sep. 1973 17 p
(NASA-Case-GSC-11786-1; US-Patent-Appl-SN-401919) Avail: NTIS HC $3.00 CSCL 11C

An ultraviolet light reflective coating is disclosed which exhibits high reflectance to ultraviolet light having wavelengths down to about 2,000 Angstrom units. The coating composition comprises a dispersion of barium sulphate in an aqueous solution of a water soluble inorganic binder selected from the group consisting of alkali metal sulphates, ammonium sulphate, and mixtures of the two sulphates. The coating is preferably employed in conjunction with an alkaline primer. NASA

N74-10543*# Battelle Memorial Inst., Columbus, Ohio.
PREPARATION OF REFRACTORY CERMET STRUCTURES FOR LITHIUM COMPATIBILITY TESTING
R. L. Heestand, R. A. Jones, T. R. Wright, and D. E. Kizer Feb. 1973 48 p refs
(Contract NAS3-13465)
(NASA-CR-121130; BMI-762-11) Avail: NTIS HC $4.50 CSCL 11D

High-purity nitride and carbide cermets were synthesized for compatability testing in liquid lithium. A process was developed for the preparation of high-purity hafnium nitride powder, which was subsequently blended with tungsten powder or tantalum nitride and tungsten powders and fabricated into 3 in diameter

billets by uniaxial hot pressing. Specimens were then cut from the billets for compatability testing. Similar processing techniques were applied to produce hafnium carbide and zirconium carbide cermets for use in the testing program. All billets produced were characterized with respect to chemistry, structure, density, and strength properties. Author

N74-10544*# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.
DEVELOPMENT OF AN EXTERNAL CERAMIC INSULATION FOR THE SPACE SHUTTLE ORBITER. PART 3: DEVELOPMENT OF STABILIZED ALUMINUM PHOSPHATE FIBERS
T. Ormiston and R. A. Tanzilli Oct. 1973 38 p refs
(Contract NAS1-10533)
(NASA-CR-132331) Avail: NTIS HC $4.00 CSCL 11D

The development of reusable surface insulation materials that are thermal shock resistant and highly refractory is discussed. A stabilized, high-cristobalite, aluminum orthophosphate fiber was developed and found to possess the desired qualities. The application of such a material to heat shielding for space shuttles is examined. E.H.W.

N74-10545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BLACK SILICATE PAINTS: FORMULATION AND PERFORMANCE DATA ON OSO-H
John B. Schutt and Charles M. Shai Oct. 1973 14 p
(NASA-TM-X-70506; X-764-73-313) Avail: NTIS HC $3.00 CSCL 11C

Formulations and general procedures are given for making and applying space environmentally, as well as atmospherically stable black silicate paints. Compositions are given which meet spacecraft self-contamination requirements, have excellent heat resistance, and are strongly semiconductive. Author

N74-10546*# Whittaker Corp., San Diego, Calif. Research and Development Div.
LIQUID OXYGEN-COMPATIBLE FILAMENT-WINDING MATRIX RESIN
Edward S. Harrison Sep. 1973 24 p refs
(Contract NAS3-15832)
(NASA-CR-134464; WRD-3028) Avail: NTIS HC $3.25 CSCL 11D

Polyurethanes derived from hydroxy terminated polyperfluoro propylene oxide prepolymers were evaluated as matrix resins for filament wound composites which would be exposed to liquid (and 100% gaseous) oxygen environments. A number of structural modifications were brought about by variations in prepolymer molecular weight, and alternative curing agents which allowed retention of the oxygen compatibility. Although satisfactory performance was achieved at sub-ambient temperatures, the derived composites suffered considerable property loss at ambient or slightly elevated temperatures. To attain overall effectiveness of the composite system, upgrading of the polymer thermomechanical properties must first be achieved. Author

N74-10547*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPERTIES OF SOLID POLYMER ELECTROLYTE FLUOROCARBON FILM
William B. Alston Washington Nov. 1973 22 p ref
(NASA-TN-D-7482; E-7536) Avail: NTIS HC $2.75 CSCL 11D

The ionic fluorocarbon film used as the solid polymer electrolyte in hydrogen/oxygen fuel cells was found to exhibit delamination failures. Polarized light microscopy of as-received film showed a lined region at the center of the film thickness. It is shown that these lines were not caused by incomplete saponification but probably resulted from the film extrusion process. The film lines could be removed by an annealing process. Chemical, physical, and tensile tests showed that annealing improved or sustained the water contents, spectral properties, thermo-oxidative stability, and tensile properties of the film. The resistivity of the film was significantly decreased by the annealing process. Author

N74-10548*# Avco Corp., Lowell, Mass. Systems Div.
DEVELOPMENT OF A PROCESS FOR PRODUCING RIBBON SHAPED FILAMENTS Report for Feb. - Sep. 1973
Harold E. DeBolt and Val J. Krukonis 15 Oct. 1973 41 p
Sponsored in part by Army Air Mobility Res. and Develop. Lab.
(Contract NAS1-12103)
(NASA-CR-132319) Avail: NTIS HC $4.25 CSCL 11D

Silicon carbide (SiC) ribbon filaments were produced on a carbon ribbon substrate, about 1500 microns (60 mils) wide and 100 microns (4 mils) thick in lengths up to 2 meters (6 ft), and with tensile strengths up to 142 KN/cm sq (206 Ksi). During the course of the study, ribbon filaments of boron were also produced on the carbon ribbon substrate; the boron ribbon produced was extremely fragile. The tensile strength of the SiC ribbon was limited by large growths or flaws caused by anomalies at the substrate surface; these anomalies were either foreign dirt or substrate imperfections or both. Related work carried out on round 100 micron (4 mils) diameter SiC filaments on a 33 micron (1.3 mil) diameter, very smooth carbon monofilament substrate has shown that tensile strengths as high as 551 KN/cm sq (800 Ksi) are obtainable with the SiC-carbon round substrate combination, and indicates that if the ribbon substrate surface and ribbon deposition process can be improved similar strengths can be realizable. Cost analysis shows that 100 micron x 5-10 micron SiC ribbon can be very low cost reinforcement material. Author

N74-10549# Defence Research Information Centre, Orpington (England).
SUPER FIBRES OF POLYAMIDES ON AN INDUSTRIAL OR SEMI-COMMERCIAL SCALE
M. Russo Jul. 1973 25 p Transl. into ENGLISH from Materie Plastiche Elastomeri (Milan), v. 38, no. 4, 1972 p 315-323
(DRIC-Trans-3216; BR30560) Avail: NTIS HC $3.25

Mechanical properties and utilization of six thermal resistant polyamide and polyamidoimide fibers are discussed. The term, super fibers, indicates those fibers which are capable of retaining their mechanical and chemical properties even when subjected to high temperature for long periods. Because of these characteristics, super fibers are shown to be most interesting in a series of applications. The following fibers, which are derived from polyamides and polyamidoimides and which were introduced in current markets, are discussed. ESRO

N74-10550# Lehigh Univ., Bethlehem, Pa. Materials Research Center.
A LATEX IPN (INTERPENETRATING POLYMER NETWORK) COATING SYSTEM FOR DAMPING NOISE AND VIBRATIONS OVER A BROAD TEMPERATURE RANGE
L. H. Sperling, Tai-woo Chiu, R. G. Gramlich, and D. Thomas Jan. 1973 31 p refs
(Contract DAAD05-72-C-0175)
(AD-765511) Avail: NTIS CSCL 11/3

Based on the principles of constrained layer damping, silent paint is a two-layer coating system capable of attenuating noise and vibration over a broad temperature range. The synthesis of a latex IPN (interpenetrating polymer networks) is summarized, and the mechanical and damping behavior of the new coating system is compared to several materials intended for use as noise and vibration damping products. (Modified author abstract) GRA

N74-10551# Army Materials and Mechanics Research Center, Watertown, Mass.
DEVELOPMENT OF TEST PROCEDURES FOR IN-SITU COMPONENT STRESS-STRAIN PROPERTIES OF COMPOSITES
Ralph P. Papirno and John Campo Mar. 1973 25 p refs
(AD-765449; AMMRC-PTR-73-3) Avail: NTIS CSCL 11/4

Test procedures are presented for determining stress-strain properties of the individual components of composites. Also presented are specimen configuration, specimen construction details, test set-up, and test results on several specimens of glass/epoxy material. The procedures include a method for testing composite specimens in tension in which loading eccentricities are minimized. This method includes a technique for fabricating specimens with low eccentricity and for initial alignment of the loading train when the specimen is installed. Analysis of test results indicate that accurate, in-situ values of fiber and matrix elastic moduli can only be obtained if precise values of the

fiber volume fraction are available. The results also indicate that when the precision of fiber volume fraction value is low, inconsistent values of the in-situ moduli results. Author (GRA)

N74-10552# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.

COMBINED STRESS STRENGTH RESULTS FOR A HIGH PURITY, SLIP-CAST FUSED SILICA

Richard E. Ely 16 Jul. 1973 27 p refs
(DA Proj. 1T0-62106-A-330)
(AD-765478; RR-737) Avail: NTIS CSCL 11/2

A pressure vessel test method was used to fracture tubular specimens of a high-purity, slip-cast fused silica under ten biaxial stress states. The hoop tensile strenghts obtained were from 2990 to 4300 psi. The uniaxial compressive strengths ranged from -25,800 to -48,800 psi. Different material lots were employed and strength variation with lot were observed. The modulus of rupture, 5365 psi, also was determined for 3/4-inch diameter rods. Author (GRA)

N74-10553# United Aircraft Corp., East Hartford, Conn. Research Labs.

DEVELOPMENT OF HIGH MODULUS CARBON FIBER, TAPE AND COMPOSITES Final Report

Romeo Bourdeau, Bernarr Jacob, and Francis Galasso May 1973 56 p
(Contract DAAG46-73-C-0014; DA Proj. 1W1-62105-A-660)
(AD-765497; AMMRC-CTR-73-20) Avail: NTIS CSCL 11/4

An investigation was conducted to develop high modulus fiber, tape and composites. Attempts to produce another alloyed carbon filament similar to a B-C alloy fiber were unsuccessful, but a silicon carbide on a carbon substrate fiber was produced as a by-product. Initial studies indicated that a fiber with a strength of over 300 ksi could be produced. The effect of catalysts on the properties of a carbon tape was demonstrated. Improved properties were attained when CaCl2 and B2O3 were employed as the catalysts. Strengths of 200 ksi and modulus values as high as 100,000,000 psi were measured on a carbon tape produced from polyimide precursor tape. Carbon bodies have been produced from polyimide sheet, binder and partially oxidized carbon yarn and from partially oxidized carbon yarn alone. The use of a solvent in the latter process to form a fibrillar carbon body resulted in improved bonding between the fiber. Solid bodies were produced with strengths as high as 75 ksi. Author (GRA)

N74-10554# Battelle Columbus Labs., Ohio.

ANALYSIS OF WHITE SPOTS IN HIGH-DENSITY ALUMINA Final Report

Russell B. Bennett and Dale E. Niesz Jul. 1973 23 p refs Presented at 75th Ann. Meeting of the Am. Ceram. Soc., Cincinnati, 1 May 1973 Submitted for publication
(Contract N00014-68-C-0342; NR Proj. 032-511)
(AD-765844) Avail: NTIS CSCL 11/2

The development of white spots in translucent alumina bodies fabricated from reactive powders was investigated. Emphasis was placed on the determination of the relationships of powder preparation procedures and particulate character to the introduction of these microstructural inhomogeneities in high-density sintered alumina. The white spots were shown to consist of porous microstructure inhomogeneities and to be attributable to nonuniformities in the starting powder. The introduction of this condition during powder processing was traced, primarily by compaction analysis and electron microscopy, and found to be caused by grinding-aid additions. Elimination of the nonuniform distribution of milling aid resulted in elimination of white spots from the alumina microstructures, and was accompanied by increased strength in compacts fabricated from the dry-milled alumina powder. Author (GRA)

N74-10555# Army Foreign Science and Technology Center, Charlottesville, Va.

METHODS FOR CALCULATING THE ABLATION OF TEFLON MASS DURING ITS DEGRADATION IN A HIGH TEMPERATURE GAS STREAM

F. B. Yurevich and M. N. Tolin 13 Mar. 1973 11 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), no. 1, 1971 p 70-75
(AD-765782; FSTC-HT-23-2004-72) Avail: NTIS CSCL 07/4

A method of calculating the parameters for the entrainment of teflon mass in the neighborhood of the stagnation point of an axisymmetric blunt body as a function of the parameters of an incident high-temperature flow over a wide range of enthalpies and stagnation pressures is proposed. GRA

N74-10556# Princeton Univ., N.J. Dept. of Chemical Engineering.

ISOTHERMAL TRANSITIONS OF A THERMOSETTING SYSTEM

J. K. Gillham, J. A. Benci, and A. Noshay Aug. 1973 25 p refs Prepared in cooperation with Union Carbide Corp., Bound Brook, N.J.
(Contract N00014-67-A-0151-0024)
(AD-765765; TR-18) Avail: NTIS CSCL 11/9

A study of the curing reactions of a cycloaliphatic epoxide/anhydride system by torsional braid analysis showed the existence of two critical isothermal temperatures. Two rheologically active kinetic transitions occur during isothermal cure which correspond to gelation and vitrification. Three types of isothermal behavior occur. Methods for determining the time to gel and the time to vitrify have been developed. The time to gel obeyed the Arrhenius relationship from which an activation energy was calculated. (Modified author abstract) GRA

N74-10557# Martin Marietta Corp., Baltimore, Md.

RELATIONSHIP BETWEEN ZETA-POTENTIAL AND DISLOCATION MOBILITY

A. R. C. Westwood, R. D. Huntington, and N. H. Macmillan Aug. 1973 21 p refs
(Contract N00014-70-C-0330; NR Proj. 032-524)
(AD-766146; MML-TR-73-11C; TR-7) Avail: NTIS CSCL 11/2

A study has been made of the environment sensitivity of edge and screw dislocation motion around hardness impressions on (100) surfaces of monocrystals of MgO immersed in buffered aqueous NaCl, and of LiF immersed in water, toluene and dimethyl formamide. It is shown that for MgO edge and screw dislocation mobilities are least, and hardness greatest, when the zeta potential is near 0, thus providing a further example of the correlation between zeta-potential and hardness established in recent studies of a variety of inorganic non-metals. This study shows specifically, however, that the zeta-correlation extends also to dislocation mobility. For LiF, it is established that both near-surface edge and screw dislocation mobilities are environment-sensitive. (Modified author abstract) GRA

N74-10558# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.

EVALUATION OF METAL COMPOSITES FOR USE IN WEAPON COMPONENTS

Walter Precht and Carolyn M. Preece Jul. 1973 28 p refs (Contract DAAF03-70-C-0019; DA Proj. 1W5-62604-A-607)
(AD-766288; AMSWE-R-RR-T-6-50-73) Avail: NTIS CSCL 11/4

The concept of increasing the strength of cobalt-base alloys by dispersion hardening with a stable MC carbide was investigated. A powder metallurgy process was used to allow the cobalt alloy matrix and the specific carbide to be selected independently and combined in optimum proportions. A number of fabrication procedures have been evaluated, the most successful to date being one in which the composite is prepared by hot pressing a mixture of the elemental metal powders with fine carbide powder. On the basis of tensile strength, room temperature ductility, and oxidation resistance considerations, a composite of Co-21 w/o Cr-26 w/o Ni with 10 w/o TiC-50% VC was selected for study. The high temperature tensile properties of this composite compare very favorably with those of the current commercially available cobalt base superalloys. (Modified author abstract) GRA

N74-10559# Army Electronics Command, Fort Monmouth, N.J.

THERMODYNAMIC AND ULTRASONIC PROPERTIES OF ACRYLIC MONOMERS

A. Papayoanou and J. A. Christopulos Aug. 1973 23 p refs (DA Proj. 1S7-62705-A-056)
(AD-766263; ECOM-4142) Avail: NTIS CSCL 11/9

The paper had its origin in the study of the Brillouin spectrum

of laser radiation scattered by four acrylic monomer liquids, methyl acrylate (MA), methyl methacrylate (MMA), ethyl methacrylate (EMA), and cyclohexyl methacrylate (CHMA). Basically, this study determined the temperature dependent acoustic velocity and attenuation in the frequency interval 500-1000 MHz, i.e. in the ultrasonic to hypersonic range. Use of this data, in conjunction with other data, such as the specific heat at constant pressure, C(p), and the temperature dependent density allow one to deduce further properties and parameters of the acrylic monomers. The following text discusses the details and includes data measured, or deduced, for three additional acrylic monomers, ethyl acrylate (EA), butyl acrylate (BA), and butyl methacrylate (BMA). The extension of the calculation methods to other liquids of this homologous series is then apparent.

Author (GRA)

N74-10560# TRW Systems Group, Redondo Beach, Calif.
THERMAL STRESS BEHAVIOR OF POLYCRYSTALLINE GRAPHITE. PART 3: SPECIAL PURPOSE TESTS Technical Report, Dec. 1971 - Nov. 1972
Kenneth R. King, James O. Bird, and Jack R. Bohn Dec. 1972 89 p refs
(Contract F33615-69-C-1654; AF Proj. 7381)
(AD-756903; AFML-TR-71-152-Pt-3) Avail: NTIS CSCL 11/2

The results obtained in the final phase of a program to evaluate the thermal stress behavior of ATJ-S and AXF-5Q graphite are described. Among the questions examined were: (1) the reasons for an observed discrepancy between the measured and calculated strains in the uniaxial thermal stress tests on ATJ-S graphite; (2) the susceptibility of ATJ-S to stress reversal fracture; (3) the influence of prestressing on thermal stress test results; and (4) the influence of biaxial softening on the calculated thermal stress and strain values. An elevated temperature torsion test facility with a capacity for rapid heat-up to test temperature is described and results obtained in tests on 5 ATJ-S specimens are presented. The development of a 200 KW thermal stress testing facility which uses electron beam techniques for outside diameter heating is also described. (Modified author abstract) GRA

N74-10561# Army Foreign Science and Technology Center, Charlottesville, Va.
HANDBOOK OF SOVIET REINFORCED PLASTICS
Charles A. Petschke 31 Mar. 1973 462 p refs Transl. into ENGLISH from Russian handbook
(AD-766311; FSTC-CW-01-102-73) Avail: NTIS CSCL 11/9

The handbook presents designations, compositions, and properties of reinforced plastic materials available in the Soviet Union. The designation and property data are presented in handbook form to facilitate utilization. The reinforced plastics are organized first by broad category (such as silicones, phenolics, etc.) and, then, by designation within each category. The designations are tabulated according to the order of the Latin alphabet. The Soviet standard or specification number for each reinforced plastic are included in the tabular data whenever available. A selection on Soviet testing and evaluation procedures has been included to provide greater significance to the property data. The tabular data also contain general applications of reinforced plastics. GRA

N74-10261* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OUTGASSING TESTS IN SUPPORT OF A PROPOSED ASTM SPECIFICATION
John J. Park, Richard S. Marriott, William A. Campbell, Jr., and Charles L. Staugaitis *In its* Space Simulation, 7th 1973 p 437-448 ref (For availability see N74-10232 01-11)
CSCL 11D

N74-10263* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THE ABLATION PERFORMANCE OF FOAMS IN A LOW HEAT FLUX
D. H. Smith and D. R. Hender *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 465-476 refs (For availability see N74-10232 01-11)
CSCL 11G

N74-10264* LTV Aerospace Corp., Dallas, Tex.
SPACE SHUTTLE ENTRY ENVIRONMENT TESTING TECHNIQUES
E. L. Mulcahy and R. R. Rogers *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 477-487 (For availability see N74-10232 01-11)
CSCL 11D

N74-10291* Martin Marietta Corp., Denver, Colo.
QUALIFICATION OF NONMETALLIC MATERIALS FOR THE VIKING MARS LANDER
W. K. Johnson and J. Y. K. Peng *In* NASA Goddard Space Flight Center Space Simulation, 7th 1973 p 875-891 refs (For availability see N74-10232 01-11)
CSCL 11D

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N74-10562*# Analytical Mechanics Associates, Inc., Jericho, N.Y.
A COMPUTER PROGRAM TO CALCULATE ZEROES, EXTREMA, AND INTERVAL INTEGRALS FOR THE ASSOCIATED LEGENDRE FUNCTIONS
Mary H. Payne Apr. 1973 45 p refs
(Contract NAS5-21787)
(NASA-CR-132838; Rept-73-19) Avail: NTIS HC $4.25 CSCL 12A

A computer program is described for the calculation of the zeroes of the associated Legendre functions, Pnm, and their derivatives, for the calculation of the extrema of Pnm and also the integral between pairs of successive zeroes. The program has been run for all n,m from (0,0) to (20,20) and selected cases beyond that for n up to 40. Up to (20,20), the program (written in double precision) retains nearly full accuracy, and indications are that up to (40,40) there is still sufficient precision (4-5 decimal digits for a 54-bit mantissa) for estimation of various bounds and errors involved in geopotential modelling, the purpose for which the program was written. Author

N74-10563*# Analytical Mechanics Associates, Inc., Seabrook, Md.
AN ANALYTIC STUDY ON BOUNDS FOR THE ASSOCIATED LEGENDRE FUNCTIONS
Mary H. Payne Jul. 1973 67 p refs
(Contract NAS5-21787)
(NASA-CR-132837; Rept-73-35) Avail: NTIS HC $5.50 CSCL 12A

The bounds for the normalized associated Legendre functions P sub nm were studied to provide a rational basis for the truncation of the geopotential series in spherical harmonics in various orbital analyses. The conjecture is made that the largest maximum of the normalized associated Legendre function lies in the interval which indicates the greatest integer function. A procedure is developed for verifying this conjecture. An on-line algebraic manipulator, IAM, is used to implement the procedure and the verification is carried out for all n equal to or less than 2m, for m = 1 through 6. A rigorous proof of the conjecture is not available. Author

N74-10564*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FINITE ELEMENT METHOD FOR THERMAL ANALYSIS
Janeth Heuser Washington Nov. 1973 64 p refs
(NASA-TN-D-7274; G-7309) Avail: NTIS HC $3.50 CSCL 12A

A two- and three-dimensional, finite-element thermal-analysis program which handles conduction with internal heat generation, convection, radiation, specified flux, and specified temperature boundary conditions is presented. Elements used in the program are the triangle and tetrahedron for two- and three-dimensional analysis, respectively. The theory used in the program is developed, and several sample problems demonstrating the capability and

reliability of the program are presented. A guide to using the program, description of the input cards, and program listing are included. Author

N74-10565# National Aerospace Lab., Tokyo (Japan).
A CONVERGENCE THEOREM OF NONLINEAR SEMIGROUPS AND ITS APPLICATION TO FIRST ORDER QUASILINEAR EQUATIONS
Tadayasu Takahashi Jun. 1973 22 p refs
(NAL-TR-318T) Avail: NTIS HC $3.25

The convergence of nonlinear semigroups and the difference approximation for the Cauchy problem for a scalar quasilinear equation from the viewpoint of the approximation theory for nonlinear semigroups. The convergence of difference approximation for the Cauchy problem is interpreted by the approximation theory for nonlinear subgroups. The results furnish a semigroup theoretical approach to the difference approximation for the Cauchy problem at the same time present another method for constructing the semigroup solution of the Cauchy problem. Author

N74-10566*# Texas Univ., Austin. Applied Mechanics Research Lab.
MODEL ERROR COMPENSATION TECHNIQUES FOR LINEAR FILTERING Final Report
Hamilton Hager, Jr. Aug. 1973 299 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953147; Grant AF-AFOSR-72-2232)
(NASA-CR-135984; AMRL-1055) Avail: NTIS HC $17.00 CSCL 12A

The exceptional utility and performance of the sequential, linear, unbiased, minimum variance estimator suffers severely in the presence of dynamic model errors. This problem, perhaps the greatest detriment to the so-called Kalman filter algorithm, is discussed in light of its divergent effect upon the estimation process. A number of optimal and suboptimal modifying techniques are described which attempt to prevent this divergence. Extensions are developed resulting in adaptive forms and a new algorithm is derived for sequentially estimating the state noise covariance matrix. Performance of the techniques is illustrated by their application to: (1) the terminal phase of an earth orbit rendezvous mission; and (2) the heliocentric trajectory determination of a solar electric propulsion space vehicle. Numerical results indicate that the model error difficulties can be sufficiently countered, with particularly effective performance being supplemented by the sequential state noise covariance estimator. Author

N74-10567*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN APPLICATION OF A LINEAR PROGRAMING TECHNIQUE TO NONLINEAR MINIMAX PROBLEMS
James R. Schiess Washington Nov. 1973 25 p refs
(NASA-TN-D-7294; L-8789) Avail: NTIS HC $2.75 CSCL 12A

A differential correction technique for solving nonlinear minimax problems is presented. The basis of the technique is a linear programing algorithm which solves the linear minimax problem. By linearizing the original nonlinear equations about a nominal solution, both nonlinear approximation and estimation problems using the minimax norm may be solved iteratively. Some consideration is also given to improving convergence and to the treatment of problems with more than one measured quantity. A sample problem is treated with this technique and with the least-squares differential correction method to illustrate the properties of the minimax solution. The results indicate that for the sample approximation problem, the minimax technique provides better estimates than the least-squares method if a sufficient amount of data is used. For the sample estimation problem, the minimax estimates are better if the mathematical model is incomplete. Author

N74-10568# Joint Publications Research Service, Arlington, Va.
SECOND ALL-UNION CONFERENCE ON GAME THEORY: THESES OF REPORTS AND ABSTRACTS
8 Nov. 1971 231 p refs Transl. into ENGLISH of the monograph "II Vsesoyuznaya Konferentsiya po Teorii IGR" Vilnyus, 1971 149 p
(JPRS-54424) Avail: NTIS HC $13.75

Reported research considers: (1) Solution and nucleus of acyclic ratio in a compact; (2) compatibility of coalitional orderings; (3) persuit games with incomplete information; (4) multiciphered transformations and the theory of differential games; and (5) criteria for the optimum in noncoalition games. Included are also 104 abstracts of pertinent studies. G.G.

N74-10569*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED METHODS FOR THE SOLUTION OF DIFFERENTIAL EQUATIONS
Marvin E. Goldstein and Willis H. Braun Washington 1973 359 p refs
(NASA-SP-316; LC-73-600126) Avail: NTIS MF $1.45; SOD HC $3.70 CSCL 12A

This book is based on a course presented at the Lewis Research Center for engineers and scientists who were interested in increasing their knowledge of differential equations. Those results which can actually be used to solve equations are therefore emphasized; and detailed proofs of theorems are, for the most part, omitted. However, the conclusions of the theorems are stated in a precise manner, and enough references are given so that the interested reader can find the steps of the proofs. Author

N74-10570# Army Materials and Mechanics Research Center, Watertown, Mass.
A NEW METHOD FOR LINEAR DYNAMICAL PROBLEMS IN CONTINUUM MECHANICS WITH RANDOM LOADS
Frederic Y. M. Wan (MIT) Jan. 1973 28 p refs
(DA Proj. 1T0-61102-B-33A)
(AD-766165; AMMRC-TR-73-1) Avail: NTIS CSCL 20/11

Linear dynamical problems in continuum mechanics are usually formulated as initial-boundary value problems in linear partial differential equations. For problems with random forcings, the paper proposes a general, rigorous, and practical method for the determination of second-order statistics of the response. The essential feature of the method is the formulation of an initial-boundary value problem for the (matrix) spatial correlation which contains the mean square response as a special case. The (matrix) auto-correlation function is determined by another initial-boundary value problem with the spatial correlation function as the initial condition. The method is particularly useful for problems for which no other practical method is available, and it is competitive with an available method for problems solvable by both. Author (GRA)

N74-10571# Wisconsin Univ., Madison.
EXACT BOUNDARY VALUE CONTROLLABILITY THEOREMS FOR WAVE AND HEAT PROCESSES IN STAR-COMPLEMENTED REGIONS Technical Report, 1 Oct. 1972 - 30 Sep. 1973
David L. Russell 16 Aug. 1973 34 p refs
(Contract N00014-67-A-0128-0018; Proj. 041-404)
(AD-765757; TR-3) Avail: NTIS CSCL 12/1

Equations are presented for an exact controllability problem for various wave and heat processes. Boundary value theorems are given with an assumption of star-complemented regions. Decay estimates for solutions of the wave equation in an exterior domain show that any finite energy state can be steered to any other state with control. A result for the heat equation is also presented. T.M.R.

N74-10437 Institut Franco-Allemand de Recherches, St. Louis (France).
EFFECT OF THE RATE OF FIRING ON ACCURACY INVESTIGATED BY MEANS OF MONTE CARLO METHOD [MONTE-CARLO SPIELE ZUR UNTERSUCHUNG DES KADENZEINFLUSSES AUF DIE TREFFGENAUIGKEIT]
V. Fleck and H. Molitz *In its* Papers on Ballistics and Phys. of Transience 1973 p 15-34 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N74-10572 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 135, NO. 4: RESULTS OF THE SYNOPTIC SERVICE DURING 1973. DAILY WEATHER MAPS (GROUND, 500 mb), TABLES AND BRIEF SCIENTIFIC ARTICLES, APRIL [METEOROLOGISCHE ABHANDLUNGEN. BAND 135, HEFT 4: ERGEBNISSE DES SYNOPTISCHEN DIENSTES IM JAHRE 1973. TAEGLICHE UND MONATLICHE WETTERKARTEN (BODEN, 500 mb), TABELLEN UND KLEINERE WISSENSCHAFTLICHE AUFSAETZE, APRIL]
1973 198 p refs In GERMAN
Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level and 500 mb heights and temperature analyses of constant pressure levels for April 1973 are presented based on rawinsonde and stratospheric rocket sounding data. Corresponding monthly mean maps, their variations and deviations are included as well as the mean grid point data calculated from daily values. Included brief scientific studies cover atmospheric aerosol content and hail occurences in Berlin vicinity, graphical determinations of geostrophical vorticity, winter sport climatology, and radioactivity measurements. Transl. by G.G.

N74-10573 Freie Univ., Berlin (West Germany).
METEORLOGICAL DATA. VOLUME 134, NO. 1: THE STRATOSPHERIC CIRCULATORY FLOW DURING 1960 AND 1962 AS ILLUSTRATED BY MONTHLY MEDIAN CHARTS OF THE 30- AND 10-mb LEVELS, AND ITS ROLE DURING THE PERIOD 1958 - 1969 [METEOROLOGISCHE ABHANDLUNGEN. BAND 134, HEFT 1: DER ZIRKULATIONSABLAUF IN DER STRATOSPHAERE IN DEN JAHREN 1960 UND 1962 AN HAND MONATLICHER MITTELKARTEN DER 30-UND 10-MB-FLAECHE UND SEINE ROLLE IN DER PERIODE, 1958 - 1969]
Ingrid Buschner 1973 202 p In GERMAN
Avail: Issuing Activity

The relation of the years 1960 and 1962 to the period of 1958-1969, which equals about one sunspot period was investigated. For the summer months May to September, it is shown, using the deviations from the long-term mean, that about four years after the sunspot maximum, the 10-mb level is lowest over the Asian part of the polar region and over northwest Siberia, but highest over Africa; and about four years after the sunspot minimum the anomalies are distributed almost completely reverse. It has been observed that in the years 1960 and 1962 the anomaly centers moved along similar tracks over several months. A relation also exists between the monthly deviation areas and the variation of the zonal wind component at the 10-mb level over Canton Island as follows: three to four months after the change of the tropical winds from east to west and vice versa, at first the polar low and then the Aleutian high exhibit extreme center values in the monthly mean maps. The development is described of the stratospheric circulation of the years 1960 and 1962, using the monthly mean maps of the 30-mb and 10mb levels, their changes from month to month, and their deviations from the long-mean 1958 - 1967. These two years were compared with the mean annual conditions over the Northern Hemisphere. Author

N74-10574 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 132, NO. 1: DAILY ALTITUDE MAPS OF THE 30 mb LEVEL AS WELL AS MONTHLY MEANS MAPS FOR 1972, PARTS 1 AND 2 [METEOROLOGISCHE ABHANDLUNGEN. BAND 132, HEFT 1: TAEGLICHE HOEHENKARTEN DER 30-mb-FLAECHE SOWIE MONATLICHE MITTELKARTEN FUER DAS JAHR 1972, TEIL I UND II, 1. UND 2. VIERTELJAHR]
1973 249 p In GERMAN; ENGLISH summary
Avail: Issuing Activity

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University It contains daily height and temperature analyses of constant pressure levels for half of a year for the whole of the Northern Hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author

N74-10575 National Lending Library for Science and Technology, Boston Spa (England).
CHARACTERISTICS OF ATMOSPHERIC TURBULENCE IN FOREST CONDITIONS
Yu. L. Rauner and I. P. Ananev Aug. 1973 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR Geogr. (USSR), v. 1, no. 2, 1971 p 70-79
(NLL-RTS-8202)

Micrometeorological effects of atmospheric turbulence on the forest vegetation layer were studied by analyzing aspiration psychrometer-, contact aneomometer-, radiation flux-, and soil and atmospheric temperature-measurement data. Results show that in the upper half of the crown canopy space there is a positive thermal radiation balance with the integral phytomass surface temperature about 3 to 4 deg higher than the air temperature; in addition to turbulent heating there is also radial heating of the air layer contiguous to the crown. It is also found that the diminishing effect of a leaf canopy on the air momentum flux is much more pronounced at weak wind velocities. G.G.

N74-10576 Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 130, NO. 3: AEROLOGICAL DATA BERLIN-TEMPELHOF, APRIL - JUNE 1972 [METEOROLOGISCHE ABHANDLUNGEN. BAND 130, HEFT 3: AEROLOGISCHE DATEN BERLIN-TEMPELHOF, APRIL - JUNI 1972]
1973 294 p refs In GERMAN; ENGLISH summary
Avail: Issuing Activity

The results of the radiosonde and ozone-sonde ascents performed by the aerological station of the Institut fuer Meteorologie der Freien Universitat Berlin are presented in tabular and graphical form. Extreme and mean values of the temperature, pressure, geopotential, wind data, refractivity, pseudopotential temperature and velocity of sound, were extracted for all standard pressure surfaces, several height levels, the tropopause and the freezing level. Author

N74-10577 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 135, NO. 5: RESULTS FROM THE SYNOPTICAL SERVICE DURING 1973. DAILY AND MONTHLY WEATHER MAPS (GROUND, 500 MB), TABLES AND BRIEF SCIENTIFIC STUDIES
1973 253 p In GERMAN
Avail: Issuing Activity

Daily and monthly Northern Hemisphere ground level and 500 mb height and temperature maps at constant pressure levels are presented based on rawinsonde and stratospheric rocket sounding data. Corresponding monthly mean maps, their variations and deviations are included as well as the mean grid point data calculated from daily values. Included brief scientific studies cover snow measurements during the winter 1972/73, statistics of seven day rain periods, and temperature and precipitation measurements for the Berlin vicinity. Transl. by G.G.

N74-10578*# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
A SIMPLE METHOD FOR THE DETERMINATION OF EFFECTIVE RAIN CELL DIMENSIONS AND ORIENTATION
D. B. Hodge Sep. 1973 17 p refs
(Grant NGR-36-008-080)
(NASA-CR-132859; ESL-2374-15) Avail: NTIS HC$3.00 CSCL 04B

A simple method is proposed for the determination of effective

rain cell dimensions and orientation. Two rain cell models were considered: the circular cell and the elliptical cell. In both models it is assumed that the rain rate is constant throughout the cell, that all cell locations are equally likely, and that the cell dimensions depend upon the rain rate. It is then shown that the effective cell dimensions and orientation may be deduced from rain rate statistics accumulated at two or three closely spaced sites, depending upon the model chosen. The results of this study alone with previous estimates of rain cell dimension indicate that the rain rate measurement points should be spaced on the order of one-half kilometer apart. The proposed method is simple and relatively inexpensive; thus, this approach is readily suited to the study of the dependence of rain cell size and orientation upon climatic region. The resulting rain cell characteristics are of direct value in the prediction of millimeter wavelength attenuation statistics on both single-terminal and diversity earth-space propagation paths as well as point-to-point terrestrial links. Author

N74-10579# National Environmental Satellite Service, Washington, D.C.
ENVIRONMENTAL SATELLITE IMAGERY, AUGUST 1973
Aug. 1973 98 p refs
(KMRD-54) Avail: NTIS HC $7.00

Hemispheric mosaics for NOAA 2, prepared daily by high speed computers, are presented for August, 1973. The orbit, scanning radiometer, mosaics, and brightness representation are described. F.O.S.

N74-10580*# Kansas Univ. Center for Research, Inc., Lawrence.
THE METEOROLOGICAL EFFECTS ON MICROWAVE APPARENT TEMPERATURES LOOKING DOWNWARD OVER A SMOOTH SEA
Steve Wu Washington NASA Nov. 1973 37 p refs
(Contract NAS1-10048)
(NASA-CR-2325; TR-186-1) Avail: NTIS HC $3.00 CSCL 04B

The effects of clouds and rain on microwave apparent temperatures for a flat sea surface are examined. The presence of clouds and rain can be expressed as a change of absorption coefficient and the total absorption is computed as the sum of individual effects. Various cloud and rain models proposed by meteorologists are employed to compute the microwave apparent temperature when viewing downward through these model atmospheres. It is shown that stratus, cumulus, overcast, and rain all contribute significantly to the observed temperature. Larger sensitivities to clouds and rain are observed for horizontally polarized apparent temperature at large nadir angles than for vertically polarized apparent temperature. Author

N74-10581# RAND Corp., Santa Monica, Calif.
CLOUD DYNAMICS AND MODELING
Francis W. Murray Jul. 1973 10 p Presented at Conf. on Modeling Rainout/Washout for Mil. Damage Assessment Analysis, Menlo Park, Calif., 24-25 Jul. 1973; sponsored by Defense Nucl. Agency
(P-5054) Avail: NTIS HC $3.00

The Rand Cumulus Dynamics Model is discussed in the context of meteorological modeling in general. The model involves numerical solution of the hydrodynamic and thermodynamic equations pertinent to motions of the scale of a convective cloud together with solution of parameterized equations for the microphysical processes of condensation and evaporation. Provision is made in the model for fallout of the larger drops, resulting in rain that may reach the ground. The possible extension of this type of model to the rainout/washout problem is discussed. Author

N74-10582*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MULTISPECTRAL STUDY OF AN EXTRATROPICAL CYCLONE WITH NIMBUS 3 MEDIUM RESOLUTION INFRARED RADIOMETER DATA
Robert Holub and William E. Shenk Washington Nov. 1973 72 p refs
(NASA-TN-D-7184; G-1085) Avail: NTIS HC $3.50 CSCL 04B

Four registered channels (0.2 to 4, 6.5 to 7, 10 to 11, and 20 to 23 microns) of the Nimbus 3 Medium Resolution Infrared Radiometer (MRIR) were used to study 24-hr changes in the structure of an extratropical cyclone during a 6-day period in May 1969. Use of a stereographic-horizon map projection insured that the storm was mapped with a single perspective throughout the series and allowed the convenient preparation of 24-hr difference maps of the infrared radiation fields. Single-channel and multispectral analysis techniques were employed to establish the positions and vertical slopes of jetstreams, large cloud systems, and major features of middle and upper tropospheric circulation. Use of these techniques plus the difference maps and continuity of observation allowed the early detection of secondary cyclones developing within the circulation of the primary cyclone. An automated, multispectral cloud-type identification technique was developed, and comparisons that were made with conventional ship reports and with high-resolution visual data from the image dissector camera system showed good agreement. Author

N74-10583*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PREDICTION OF ENGINE EXHAUST CONCENTRATIONS DOWNWIND FROM THE DELTA-THOR TELSAT-A LAUNCH OF 9 NOVEMBER 1972
John W. Kaufman, Michael Susko, and C. Kelly Hill Washington Nov. 1973 50 p refs
(NASA-TM-X-2939; M-120) Avail: NTIS HC $3.00 CSCL 04B

Results are presented of the downwind concentrations of engine exhaust by-products from the Delta-Thor Telsat-A vehicle launched from Cape Kennedy, Florida on November 9, 1972 (2014 EST). The meteorological conditions which existed are identified as well as the exhaust cloud rise and the results from the MSFC Multilayer Diffusion Model calculations. These predictions are compared to exhaust cloud sampled data acquired by the Langley Research Center personnel. Values of the surface level concentrations show that very little hydrochloric acid, carbon monoxide, or aluminum oxide reached the ground. Author

N74-10584*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A BUOYANT TORNADO-PROBE CONCEPT INCORPORATING AN INVERTED LIFTING DEVICE
Frederick C. Grant Washington Nov. 1973 29 p refs
(NASA-TN-D-7335; L-8969) Avail: NTIS HC $3.00 CSCL 04B

Addition of an inverted lifting device to a simple balloon probe is shown to make possible low-altitude entry to tornado cores with easier launch conditions than for the simple balloon probe. Balloon-lifter combinations are particularly suitable for penetration of tornadoes with average to strong circulation, but tornadoes of less than average circulation which are inaccessible to simple balloon probes become accessible. The increased launch radius which is needed for access to tornadoes over a wide range of circulation results in entry times of about 3 minutes. For a simple balloon probe the uninflated balloon must be first dropped on, or near, the track of the tornado from a safe distance. The increase in typical launch radius from about 0.75 kilometer to slightly over 1.0 kilometer with a balloon-lifter combination suggests that a direct air launch may be feasible. Author

N74-10585# Swiss Inst. of Meteorology, Zurich.
THE PRECIPITATION EFFECTIVENESS OF PRONOUNCED, HIGH ALTITUDE COLD AIR FRONTS DURING SUMMER IN SWITZERLAND [DIE NIEDERSCHLAGSWIRKSAMKEIT MARKANTER, HOCHREICHENDER KALTLUFTEINBRUECHE IM SOMMER IN DER SCHWEIZ]
H. W. Courvoisier 1973 12 p ref In GERMAN; ENGLISH summary
(Rept-29) Avail: NTIS HC $3.00

The effect of marked invasions of cold air, in summer, on precipitation was analyzed for different regions of Switzerland. It appears that a strong diminution of the 500 mb level is a sufficient condition for intense precipitations in a great part of Switzerland. A quantitative representation of the precipitation conditions was desirable, because the synoptic development of such a situation was often deceptive and frequently led to incorrect

forecasts. Rather intense precipitations on the northern side of the Alps, and in other regions of Switzerland may be expected even if there is no significant rainfalls in the plains of Western and Central Europe. With the help of numerical forecast charts and the knowledge of the regional effect of precipitation regarding these weather types, it should be possible to avoid wrong forecasts. The forecasting method is of great use to water resources, agriculture and tourism. Author

N74-10586# Physisch Laboratorium RVO-TNO, s-Gravenhage (Netherlands).
CALCULATION OF THE STATISTICAL DISTRIBUTION OF THE CLOUD FACTOR FOR DIFFERENT PARTS OF EUROPE
A. J. B. C. Bal, T. F. Risselada, and J. VanSchie Jun. 1973 25 p refs
(PH.L.1973.28) Avail: NTIS HC $3.25

A comparison is made of the distribution of the cloud factor for different European weather stations. The results show that West Europe forms a unity in respect to the natural illumination. The distributions of the cloud factor and the illuminance values are presented for this area. Author

N74-10587# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC POLLUTION IN BELGIUM DUE TO SULFUR OXIDES AND SMOKE DURING THE PERIOD 1 APRIL 1970 TO 31 MARCH 1971 [LA POLLUTION ATMOSPHERIQUE PAR LES OXYDES DE SOUFRE ET LA FUMEE EN BELGIQUE AU COURS DE LA PERIODE DU 1 AVRIL 1970 AU 31 MARS 1971]
A. Derouane, J. Grandjean, M. Legrand, and G. Verduyn 1973 86 p refs In FRENCH and DUTCH Prepared jointly with Inst. d'Hyg. et d'Epidemiol.
(Publ-Ser-A-82) Avail: NTIS HC $6.50

Sulfur oxide and smoke concentration data recorded at various Belgian stations in order to determine the amount of atmospheric pollution are given for the period 1 April 1970 to 31 March 1971. ESRO

N74-10588# Institut Royal Meteorologique de Belgique, Brussels.
CLIMATOLOGICAL OBSERVATIONS Monthly Bulletin, Jun. 1973 [OBSERVATIONS CLIMATOLOGIQUES BULLETIN MENSUEL, JUIN 1973]
Jun. 1973 15 p In FRENCH and DUTCH
Avail: NTIS HC $3.00

Meteorological parameters observed at different Belgian weather stations during June 1973 are given. ESRO

N74-10589# World Meteorological Organization, Geneva (Switzerland).
SOME METHODS OF CLIMATOLOGICAL ANALYSIS
H. C. S. Thom 1971 66 p refs
(WMO-199; TP-103; TN-81) Avail: NTIS HC $5.50; WMO, Geneva

The basic principles of climatological prediction are introduced. After defining a climatological series to lay the basis for valid statistical analysis, the fundamental frequency distributions are treated including the normal, gamma, extreme value, binomial, and Poisson distributions. Best estimates for the parameters are given together with complete instructions for fitting them to data. Examples of their application to climatological series are worked out. Correlation and regression analysis are discussed including linear regression forced through the origin. The propagation of variance in climatological series is treated, including the covariance effect. Standard errors of the regression and of the forecast are presented. The simple regression and multiple correlation methods are extended to two independent and finally to many independent variables. ESRO

N74-10590# World Meteorological Organization, Geneva (Switzerland).
REVIEW OF FORECAST VERIFICATION TECHNIQUES
E. M. Dobryshman 1972 62 p refs Presented at the 5th Session of the Comm. for Synoptic Meteorol., Geneva, 15 Jun. - 3 Jul. 1970
(WMO-303; TN-120) Avail: NTIS HC $5.25; WMO, Geneva

A brief survey of methods for forecast verification is given. The necessity of developing a strict terminology and defining the various forms of atmospheric phenomena (slight rain, shower, etc) is discussed and rules for the wording of forecasts are given. ESRO

N74-10591# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: FIFTH STATUS REPORT ON IMPLEMENTATION
Jul. 1972 173 p refs
(WMO-334) Avail: NTIS HC $10.75

The Global Observing System, the Global Data processing System and the Global Telecommunication System, are dealt with. Each part of the report presents, in a summarized form, a statement of the implementation of the plan in the particular field and the improvements which may be expected in the years to come. Wherever possible, the methods whereby the improvements may be expected, i.e. national resources, UNDP, bilateral programs and the WMO Voluntary Assistance Program are also indicated. Information received from members of WMO and non-member countries during the first half of 1972 was considered. Where appropriate this is presented in the form of tables which give global and regional data. In other cases regional information is presented in the form of charts and diagrams. The main features and trends are presented in the descriptive sections. ESRO

N74-10592# World Meteorological Organization, Geneva (Switzerland).
BENEFIT AND COST ANALYSIS OF HYDROLOGICAL FORECASTS: A STATE-OF-THE-ART REPORT
Harold J. Day 1973 43 p refs
(WMO-341; OHR-3) Avail: NTIS HC $4.25; WMO, Geneva

Recent progress in evaluating the benefits and costs of hydrological forecasts are presented to provide guidance in the decision making process in water resources management. Flood forecasting is described as a particular example of a comprehensive basin analysis procedure which may serve as a basis for other forecast applications. Concepts of hydraulics, hydrology, and economics were combined to develop an analysis procedure similar to that used for flood damage evaluation studies related to structural changes. Emphasis is laid on three factors with regard to a flood damage reduction program, namely warning time length, reducible damage magnitude, and response to warning efficiency to permit decisions to be taken for flood prevention on economic grounds. Mathematical models for simulating flood damage reduction alternatives are described. ESRO

N74-10593# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF PROCESSES IN THE BOUNDARY LAYER DURING NUMERICAL SIMULATION OF THE GENERAL CIRCULATION OF THE ATMOSPHERE
A. S. Dubov and L. R. Orlenko 8 Aug 1973 23 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Obs. (Leningrad), no. 256, 1970 p 45-56
(AD-765994; FTD-HT-23-596-73) Avail: NTIS CSCL 04/2

The report studies specific features of processes in layers of the atmosphere where energy exchange occurs most intensively. GRA

N74-10594# Naval Postgraduate School, Monterey, Calif.
NUMERICAL SIMULATION OF STEADY-STATE FRONTS Annual Report, 1 Jul. 1972 - 30 Jun. 1973
Roger T. Williams Aug. 1973 33 p refs
(AD-765683; NPS-51WU73081A) Avail: NTIS CSCL 04/2

The numerical frontogenesis model of Williams (1972) is modified to include horizontal and vertical turbulent diffusions of heat and momentum. The turbulent diffusions are represented with constant coefficients, and an Ekman layer is added to the basic deformation field. The numerical solutions show realistic quasi-steady fronts forming within 1 - 2 days. These solutions are examined and compared over a wide range of the various coefficients. Author (GRA)

N74-10595# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIMPLIFIED MODEL FOR NUMERICAL EXPERIMENTS ON THERMAL CONDITIONS OF THE ATMOSPHERE
L. S. Gandin, R. L. Kagan, V. P. Meleshko, and L. V. Rukhovets 10 Aug. 1973 40 p refs Transl. into ENGLISH from Gl. Geofizicheskaya Observ., Leningrad (USSR), no. 256 p 72-97
(AD-766036; FTD-HT-23-607-73) Avail: NTIS CSCL 04/2

The report describes a thermotropic quasigneostrophic nonadiabatic atmosphere model taking into account thermal conditions on atmospheric circulation and climatology. GRA

N74-10596# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITIES OF THE IDENTIFICATION OF PRECIPITATION ZONES WITH MISZ METEOROLOGICAL ARTIFICIAL EARTH SATELLITES
A. G. Gorelik, V. V. Kalashnikov, and Yu. A. Frolov 9 Aug. 1973 19 p refs Transl. into ENGLISH from Tsentr. Aerol. Observ. (USSR), no. 103, 1972 p 31-41
(AF Proj. 3005)
(AD-766035; FTD-MT-24-699-73) Avail: NTIS CSCL 04/2

Some theoretical questions are discussed connected with the creation of the airborne thermoviewer working in the SHF-range and intended for determining liquid-drop precipitation zones. During the creation of such an airborne instrument the initial prerequisites are the following: equipment should be small-scale, have high spatial resolution with a broad survey band of the underlying surface. Furthermore, it should possess the sensitivity sufficient for detection of rain above the different forms of underlying surface, be less sensitive to cloudiness not giving precipitation. One additional important condition which this equipment should satisfy consists of ensuring the invariability of the polarization during the reception of intrinsic emission of the underlying surface. GRA

N74-10597# Naval Weapons Center, China Lake, Calif.
PROJECT FOGGY CLOUD 4, PHASE 1. EVALUATION OF WARM FOG DISSIPATION TECHNIQUES
Edward E. Hindman, II, Richard S. Clark, and Pierre St.Amand Aug. 1973 58 p refs
(AD-766086; NWC-TP-5413) Avail: NTIS CSCL 04/2

Project Foggy Cloud IV, Phase 1, is part of a continuing series of experiments concerning the modification and dispersal of warm fog and stratus clouds. Tests were conducted at the Arcata-Eureka airport, Humboldt County, Calif., from 26 July to 7 October 1971, using a fixed-wing aircraft as a delivery vehicle. The seeding agents were water and a solution of ammonium nitrate, urea, and water developed during Project Foggy Cloud 1. The effects of the wing-tip vortices from the aircraft were investigated. One of the three definitive tests with wing-tip vortices improved the visibility above field minimums. One of the four definitive tests with water improved visibility above minimums. Three of the six definitive tests with the ammonium nitrate/urea/water solution improved visibility above minimums. The technique using the hygroscopic solution was the most effective. Author (GRA)

N74-10598# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A POLAR EQUAL-AREA MAP OF THE WORLD
Irving I. Gringorten 4 Jun. 1973 22 p ref
(AF Proj. 8624)
(AD-766207; AFCRL-TR-73-0349; AFCRL-AFSIG-269) Avail: NTIS CSCL 04/2

In the Design Climatology Branch, Air Force Cambridge Research Laboratories, there frequently arises a need for a global presentation of statistics on the climate. As in most statistical presentations the favored type of map is equal-area. But previous maps have been neglectful of the north and south polar areas. It is desirable to have a projection centered on the North Pole, with habitable land masses realistically grouped around the central point. The construction of the polar equal-area map is relatively simple for the Northern Hemisphere. In the associated representation of the Southern Hemisphere, however, several difficulties had to be overcome. Author (GRA)

N74-10599# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
EXTREMES OF 1, 12, AND 24 HOUR RAIN FOR MIL-STD-210B
Robert W. Lenhard and Norman Sissenwine 18 May 1973 24 p refs
(AF Proj. 8624)
(AD-766210; AFCRL-AFSIG-266; AFCRL-TR-73-0329) Avail: NTIS CSCL 04/2

A method is developed for estimating extreme rainfall rates from readily available climatology in the form of the precipitation index, the total annual rainfall divided by the number of days with rain. The method is expressed as an equation that estimates the rain that will fall during any selected time interval (duration of rainfall) with any desired frequency of occurrence (return period). The technique as presented is applicable to the geographic regions of intense precipitation such as the moist tropics and subtropics. (Modified author abstract) GRA

N74-10600# Defense Documentation Center, Alexandria, Va.
ATMOSPHERIC TURBULENCE Report Bibliography, Jan. 1969 - Apr. 1973
Aug. 1973 355 p refs
(AD-765490; DDC-TAS-73-50) Avail: NTIS CSCL 04/2

The bibliography is a selection of unclassified-unlimited distribution references on atmospheric turbulence. These citations of reports present information on clear air turbulence, boundary layer turbulence, storm and cloud turbulence, upper air turbulence, turbulent diffusion and dispersion, turbulence interaction with electromagnetic and acoustic waves, and spectral analysis methods. The report contains indexes of corporate-author-monitoring agency: subject, title, and personal author.
Author (GRA)

N74-10601# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DETERMINATION OF THE GENERAL MOISTURE CONTENT OF THE ATMOSPHERE FROM ITS INTRINSIC RADIO FREQUENCY EMISSION
A. G. Gorelik, V. V. Kalashinitov, and Yu. A. Frolov 16 Aug. 1973 26 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 103, 1972 p 5-20
(AF Proj. 3005)
(AD-766034; FTD-MT-24-698-73) Avail: NTIS CSCL 04/2

The purpose of this work is to outline the prospects for the radiometric methods of measurement of the moisture content of the atmosphere by its inherent thermal radiation and to discuss some of the problems appearing in this case. GRA

N74-10602# Naval Air Engineering Center, Philadelphia, Pa. Ground Support Equipment Dept.
POLLUTION IN THE GROUND SUPPORT ENVIRONMENT Final Report
Peter B. Zacharkin and William H. Womer Jul. 1973 29 p refs
(AD-764854; NAEC-GSED-69) Avail: NTIS CSCL 13/2

The study was initiated to survey the Naval Air/Ground Support environment to determine if there are pollution problems related to ground support equipment. Three major objectives exist in this study. (a) To identify specific pollution-causing systems of all types in the Navy ground support environment. (b) To recommend practical solutions to these specific pollution-causing problems. (c) To insure that all future procurements of GSE are as pollution free as practicable, by aligning the pollution limitations of GSE with the corresponding requirements for similar equipment established by EPA. GRA

N74-10603# Environmental Technical Applications Center (Air Force), Washington, D.C.
LISTING OF SEMINARS AVAILABLE AT HQ AWS, AWS WINGS, AND AFGWC
Mar. 1973 37 p refs
(AD-757543; USAFETAC-TN-73-3) Avail: NTIS CSCL 04/2

The report furnishes a complete listing of the prepared technical seminars at AWS wing headquarters which are available for loan to all AWS units for local presentation. The listing includes the seminar subject, author (where available), number of copies available, period of loan, approximate presentation time, type of illustrative material, and a brief synopsis of the seminar material. (Author modified abstract) GRA

N74-10604# Army Electronics Command, White Sands Missile Range, N. Mex.
APPARENT 7-DAY PERIOD IN VISIBILITY DATA AT WHITE SANDS MISSILE RANGE, NEW MEXICO
G. S. Rinehart and R. P. Lee Apr. 1973 18 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-757625; ECOM-5484) Avail: NTIS CSCL 04/2

A success-failure time series analysis was carried out on 3653 data points derived from 10 years of meteorological data acquired at White Sands Missile Range revealing a 7-day period in daytime visibility data. A success was classified as a day during which two consecutive visibility observations were recorded, and the surface wind speed was less than 5 m/sec for at least 12 hours prior to the visibility observation, and the relative humidity was less than 50%. These criteria were employed to minimize the influence of dust generated by locally high winds, and to reduce the influence of relative humidity in increasing atmospheric particulate concentration or size. (Author modified abstract) GRA

N74-10605# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THERMAL WARM FOG DISSIPATION: HEAT REQUIREMENTS AND PROJECTED UTILIZATION OF A SYSTEM FOR TRAVIS AFB, CALIFORNIA Air Force Surveys in Geophysics.
Alan I. Weinstein 18 Jun. 1973 31 p refs
(AF Proj. 7605)
(AD-766247; AFCRL-TR-73-0367; AFCRL-AFSIG-270) Avail: NTIS CSCL 04/2

Climatological records of fog occurrence and wind characteristics in fog are used to design a passive ground-based heat system for the dispersal of warm fog at Travis AFB, California. The array of heat sources is patterned after that described by FIDO engineers for parallel winds. The burner array shape is similar to an elongated horseshoe that encloses the upwind end of the runway, with the parallel legs 450 ft apart terminating 240 ft short of a 700-ft-long cross leg. An analysis of air traffic records in combination with fog statistics indicates that the system could be used to aid approximately 900 (2600) landings and takeoffs in an average (extreme) year during the fog-plagued months from November to February. Assuming a burn time of five minutes per landing or takeoff, the heaters could be expected to operate approximately 75 (260) h and consume approximately eleven (48) million gallons of fuel in an average (extreme) year. During the time the system is operating it generates heat at a rate of approximately 10 billion BTU/h. Author (GRA)

N74-10606# Arizona Univ., Tucson.
RECONSTRUCTION OF PAST CLIMATIC VARIABILITY Semiannual Technical Report, 1 Jan. - 29 Jun. 1973
Harold C. Fritts, M. A. Stokes, Jeffrey S. Dean, M. A. Wiseman, and Charles W. Stockton 1 Jul. 1973 44 p refs
(Grant AF-AFOSR-2406-72; ARPA Order 2221)
(AD-765663; AFOSR-73-1420TR; SATR-2) Avail: NTIS CSCL 04/2

Ring width chronologies are obtained from sites throughout North America and Europe. When the network of sites has sufficient aereal coverage the hemisphere-wide variations in the recorded climate will be calibrated with variations in growth and these calibrations used to reconstruct past climate for time periods when tree-ring data are available but climatic data do not exist. Progress on collection and processing of data is described and developing plans for international cooperative efforts are discussed. Author (GRA)

N74-10607# National Research Council, Washington, D.C.
HIGHWAYS AND AIR QUALITY
1973 95 p refs
(PB-222344/4; HRB-HSR-73-141; ISBN-0-309-02165-0; LC-73-8482) Avail: NTIS MF $1.45; National Academy of Sciences, Washington, D. C. HC $2.80 CSCL 13B

Recognizing the significant contribution of motor vehicles to air pollution in a number of urban areas, the Congress enacted the Clean Air Amendments of 1970 (84 Stat. 1676) that require substantial reductions in carbon monoxide and hydrocarbon emissions from light-duty motor vehicles beginning with the 1975 model year. Questions as to the technical feasibility of emission standards, particularly the 1975-76 standards, their economic impact, trade-offs with standards for stationary sources of air pollution, and so on are being explored in other studies and are not the subject of the report. This report instead deals primarily with changes that can be made and techniques that can be used in the planning and operation of transportation systems and facilities to minimize motor vehicle air pollution and its impact. (This report does not deal with transportation controls for air pollution emergency episodes). Author (GRA)

N74-10608# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
SURVEY OF WEATHER MODIFICATION IN THE SOVIET UNION, 1973
Louis J. Battan 15 May 1973 55 p refs
(Grant NSF GA-13949)
(PB-222822/9; UA-IAP-SR-73-27; NSF-RA/E-73-001) Avail: NTIS HC $4.75 CSCL 04B

On the basis of a review of abstracts of articles published mostly since 1969, a summary has been prepared of Soviet research in weather modification. Hail suppression and precipitation stimulation still are major areas of activity in the USSR, but in recent years they have begun to do research on lightning suppression and the use of heat for the dissipation of warm fog in stratus. (Modified author abstract) GRA

N74-10609# Wyoming Univ., Laramie. Water Resources Research Inst.
WATER RESOURCE OBSERVATORY WIND AND SOLAR RADIATION DATA, WATER YEAR 1972
Verne E. Smith Jun. 1973 65 p Sponsored by Dept. of Interior
(OWRR Proj. A-010-WYO(1))
(PB-222914/4; W73-13660; Ser-46) Avail: NTIS HC $3.50 CSCL 04B

Wind data that have been reduced from recording anemometer charts and from readings of totalizing anemometers plus incident solar radiation data from various stations operated by the University of Wyoming in and adjacent to Laramie, Wyoming, are presented in tabular form. The period covered is from October 1971 to October 1972. The study includes an investigation on the biophysical relationships in the hydrologic cycle. (Modified author abstract) GRA

N74-10610# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie.
METEOROLOGICAL DATA. VOLUME 83, NO. 3: DAILY AND MONTHLY NORTHERN HEMISPHERE 5-MILLLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1968, APRIL-JUNE Quarterly Technical Status Report no. 3
Barbara Kriester, Karin Labitzke, Karin Petzoldt, and Karl Sieland 1973 118 p refs
(Contract DAJA37-71-C-0993; DA Proj. 2Mo-61102-B-53B)
(AD-759965) Avail: NTIS; Institute for Meteorology and Geophysics of the Free University of Berlin, Berlin, Germany CSCL 04/2

The present volume contains a series of stratospheric weather maps for the 5-mb-level. Included are daily height and temperature analyses for three month for the Northern Hemisphere based on radiosonde and rocketsonde measurements and performed by using a hydrostatic buildup method. The corresponding monthly mean maps and their variations are included as well as the mean grid point data calculated from the daily values. The circulation pattern during the period under consideration is described with special emphasis on the processes at high latitudes. Author (GRA)

N74-10611# Weather Wing (3rd), Offutt AFB, Nebr.
THERMAL PARAMETERS AS A PREDICTOR OF PRECIPITATION TYPE FOR KINCHELOE AFB, MICHIGAN
Limon E. Forter, Jr., Dale G. Rogers, Michael P. Cranciolo, and Barry W. Satchwell Feb. 1973 23 p refs Revised
(AD-754927; Rept-3WW-TN-72-1-Rev) Avail: NTIS CSCL 04/2

The paper presents a summary of thermal parameters as predictors of precipitation type at Kincheloe AFB, MI. The material presented in this paper may be used in the preparation of an objective forecast when the input data is extracted from current

observations and prognostic facsimile charts. The Sault Ste. Marie, MI, radiosonde data (0000Z and 1200Z) are correlated against precipitation type that occurred at Sault Ste. Marie AFB, MI. Thermal parameter combinations used in this study are: 1000-850mb thickness, 1000-700mb thickness, 1000-500mb thickness, 850-700mb thickness; surface, 950mb, 850mb and 700mb temperatures; 850mb wind direction. Author (GRA)

N74-10612# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
A ONE-DIMENSIONAL NUMERICAL MODEL TO STUDY THE EFFECTS OF CUMULUS CLOUDS ON THE ENVIRONMENT
Donald J. Perkey and Carl W. Kreitzberg Dec. 1972 109 p refs
(Contract F19628-69-C-0092; AF Proj. 7922)
(AD-760123; AFCRL-TR-73-0014; SR-5) Avail: NTIS CSCL 04/2

The report documents and provides a users guide for a one-dimensional numerical model to study the effects of convection on the environment. The model combines a one-dimensional Lagrangian cumulus cloud model with the basic physical processes of cyclonic scale lifting, surface eddy mixing, cloud induced environmental subsidence, sub-cloud hydrometeor water evaporation and horizontal diffusion of the dissipating cloud. Included in this documentation are a detailed model description, derivation of the model equations, a basic flow diagram, a list of program mnemonics, a description of the input data format and a model listing and output from the National Center for Atmospheric Research's Control Data 6600 and 7600 computers. Author (GRA)

N74-10613# TRW Systems Group, Redondo Beach, Calif.
TROPICAL CYCLONES Final Report, 19 Apr. 1971 - 18 Mar. 1973
Francis E. Fendell Mar. 1973 177 p refs
(Contract DAHC04-71-C-0025; ARPA Order 1786)
(AD-757084; TRW-18524-6003-RU-00) Avail: NTIS CSCL 04/2

After a brief summary of salient observational facts about cumulus convection in the tropical ambient and about tropical cyclones, models for the cyclone-scale structure and maintenance of the quasisteady mature stage of a hurricane are presented and evaluated. Principal attention is devoted to the model developed by Riehl and Malkus in the late 1950's, and to the model developed by Carrier in the early 1970's. (Author modified abstract) GRA

N74-10614# Army Missile Command, Redstone Arsenal, Ala. Physical Sciences Directorate.
WIND PROFILE PARAMETERS IN THE GROUND LAYER AND TROPOSPHERE AT MIDLATITUDES
O. M. Essenwanger 28 Jun. 1973 30 p refs
(DA Proj. 1T0-61102-B-23A)
(AD-766695; RR-736) Avail: NTIS CSCL 04/2

Three sets of wind profiles (surface to 1, surface to 2, and surface to 10 km) have been derived for a pilot station from the midlatitudes (Chateauroux, France). These profiles were parameterized by establishing mathematical-stochastic models for further application, reducing the original input by a factor 1:1000. The coefficients for these computer models are given in this report by the individual month; six levels of probability (50, 68, 84, 95, 97.7 and 99 percent) have been computed for January and July as examples. Author (GRA)

N74-10615# Mitre Corp., Bedford, Mass.
SEEK STORM RADAR SENSITIVITY STUDY
P. C. Fritsch and R. E. Jordan Aug. 1973 83 p refs
(Contract F19628-73-C-0001; AF Proj. 4530)
(AD-766650; MTR-2487; ESD-TR-73-134) Avail: NTIS CSCL 17/9

The report describes the relationship between various radar parameters, earth geometrical parameters and hurricane rain rate parameters. An attempt is made to illustrate in graphical form the radar performance sensitivity to each parameter. These sensitivity results can be used as a design basis for a realistic radar system to observe and measure important characteristics of a hurricane weather occurrence. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N74-10616*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SIRU DEVELOPMENT. VOLUME 1: SYSTEM DEVELOPMENT Final Report
J. P. Gilmore and R. J. Cooper Jul. 1973 231 p refs
(Contract NAS9-8242)
(NASA-CR-136033; R-746-Vol-1) Avail: NTIS HC $13.75 CSCL 17G

A complete description of the development and initial evaluation of the Strapdown Inertial Reference Unit (SIRU) system is reported. System development documents the system mechanization with the analytic formulation for fault detection and isolation processing structure; the hardware redundancy design and the individual modularity features; the computational structure and facilities; and the initial subsystem evaluation results. Author

N74-10617*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
SIRU UTILIZATION. VOLUME 2: SOFTWARE DESCRIPTION AND PROGRAM DOCUMENTATION
John Oehrle and Roy Whittredge Jun. 1973 313 p
(Contract NAS9-8242)
(NASA-CR-136022; R-747-Vol-2) Avail: NTIS HC $17.75 CSCL 17G

A complete description of the additional analysis, development and evaluation provided for the SIRU system as identified in the requirements for the SIRU utilization program is presented. The SIRU configuration is a modular inertial subsystem with hardware and software features that achieve fault tolerant operational capabilities. The SIRU redundant hardware design is formulated about a six gyro and six accelerometer instrument module package. The modules are mounted in this package so that their measurement input axes form a unique symmetrical pattern that corresponds to the array of perpendiculars to the faces of a regular dodecahedron. This six axes array provides redundant independent sensing and the symmetry enables the formulation of an optimal software redundant data processing structure with self-contained fault detection and isolation (FDI) capabilities. Documentation of the additional software and software modifications required to implement the utilization capabilities includes assembly listings and flow charts. Author

N74-10618# National Aviation Facilities Experimental Center, Atlantic City, N.J.
A FEASIBILITY STUDY AND PRELIMINARY EVALUATION OF THE USE OF A BIASED GLIDE SLOPE TECHNIQUE FOR NOISE ABATEMENT APPROACH Final Report, Nov. 1972 - Apr. 1973
Robert H. Pursel Nov. 1973 35 p ref
(FAA-RD-73-153; FAA-NA-73-62) Avail: NTIS HC $3.75

A feasibility study and a preliminary evaluation of the technique of conducting noise abatement approaches by using a biased glide slope deviation signal were conducted. Manual approaches using a flight director system and automatic approaches using an automatic flight control system were flown at angles up to 0.9 degrees above the commissioned glide slope angle. A ramp washout of the bias was used with the washout time constant and initiation altitude of the washout treated as variables. It was concluded that the average glide slope beam will allow a biased approach of about 0.7 degrees above the commissioned angle and that the technique is operationally feasible. Author

N74-10619*# International Business Machines Corp., Gaithersburg, Md. Electronics Systems Center.
CONTINENTAL LAND MASS AIR TRAFFIC CONTROL (COLM ATC) Final Report, Aug. 1971 - Dec. 1972
J. A. Pecar and J. E. Henrich 21 Jun. 1973 274 p refs
(Contract NAS5-21656)
(NASA-CR-132831) Avail: NTIS HC $15.75 CSCL 17G

The application of various satellite systems and techniques relative to providing air traffic control services for the continental United States was studied. Three satellite configurations were reviewed. The characteristics and capabilities of the satellites are described. The study includes consideration for the various ranging waveforms, multiple access alternatives, and the power and bandwidth required as a function of the number of users. Author

N74-10620# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROVISIONAL SIGNAL FORMATS FOR THE DISCRETE ADDRESS BEACON SYSTEM
P. Drouilhet, ed. 9 Nov. 1973 58 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002)
(ATC-30; FAA-RD-73-175) Avail: NTIS HC $5.00 CSCL 17G

The characteristics of the signals which form the Discrete Address Beacon System (DABS) interrogations and replies are defined. The utilization of the described formats to effect the surveillance and data link communication functions is discussed. The signals are used to design and construct a system test and evaluation during the DABS development program. The modifications required for an operational implementation of the DABS are identified. Author

N74-10621# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN OPTIMUM INTERFERENCE DETECTOR FOR DABS MONOPULSE DATA EDITING
R. J. McAulay and T. P. McGarty 26 Sep. 1973 37 p refs
(Contracts DOT-FA72WAI-261; F19628-73-C-0002)
(ESD-TR-73-253; TN-1973-48) Avail: NTIS HC $4.00 CSCL 17G

In the application of the Discrete Address Beacon System (DABS)concept to Air Traffic Control(ATC) surveillance, estimates of aircraft position must be made using as few replies as possible, preferably one. This requires the use of monopulse techniques. Since the beacon system provides high signal-to-noise ratios(SNR), the fundamental limitation to direction finding(DF) performance is due to externally generated interference from multipath signals and from the present Air Traffic Control Radar Beacon System (ATCRBS). Since there are many bits in any one DABS reply it should be possible to generate an accurate azimuth estimate if those that bear interference could be detected and deleted from the sample. In this report, the generalized likelihood ratio test is used to derive an optimum interference statistic. The detector performance is then analyzed in detail with respect to its dependence on SNR, interference-to-signal ratio (ISR) and on the relative phase between the target and interfering signals. It is shown that good detection performance can be obtained if the phase difference between the target and interference signals are either in- or out-of-phase. Author

N74-10622# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
A SYNCHRONIZED DISCRETE-ADDRESS BEACON SYSTEM
Thomas S. Amlie 31 Oct. 1973 10 p
(FAA-EM-74-3; FAA-AEM-1) Avail: NTIS HC $3.00

The characteristics of the secondary radar or air traffic control radar beacon system are discussed. The deficiencies of the system are described and the procedures for overcoming the deficiencies by a discrete system are proposed. The display devices in the aircraft are explained. It is stated that such a surveillance system will provide several additional benefits and services to the aircraft operator at minimum cost and complexity. Author

N74-10623# Transportation Systems Center, Cambridge, Mass.
EVALUATION OF ILS LOCALIZER SIGNAL SPECIFICATION DURING GROUND ROLLOUT Final Report, Jul 1971 - Jul. 1972
Joseph S. Koziol, Jr. Aug. 1973 99 p refs
(AD-765761; DOT-TSC-FAA-72-27; FAA-RD-73-31) Avail: NTIS CSCL 17/7

The International Civil Aviation Organization (ICAO) has developed a specification for localizer information on the runway surface appropriate for rollout guidance during Category III B operations. The suitability of this specification was evaluated by systems analysis and simulation and is reported herein. The results of the performance evaluation for a representative rollout guidance system indicate that the specification is too stringent especially for higher frequency type localizer disturbances and therefore should consider the spectral characteristics of the localizer disturbance. A more relaxed specification was therefore developed by taking additional advantage of the sensitivity effect of the localizer receiver and the attenuating effect of the rollout guidance system on localizer disturbances. GRA

N74-10624# Ohio Univ., Athens. Dept. of Electrical Engineering.
IMPLEMENTATION OF A ONE-WAY RANGING, RANGE-RANGE NAVIGATION SYSTEM Semiannual Report, 10 Oct. 1972 - 10 Apr. 1973
Jul. 1973 58 p refs
(Contract DAAB07-71-C-0156; DA Proj. 1F1-62202-AA-96) (AD-765503; ECOM-0156-7-71; SAR-7) Avail: NTIS CSCL 17/7

Computer simulation results comparing analog and digital phase estimation techniques for navigation applications were completed showing negligible difference for optimized estimator structures and identical SNR. An optimized, low cost, and highly stable digital mechanization is also described. The completion and experimental results of the phase-coherent frequency synthesizer using direct-digital methods is also reported on in this issue including complete schematic diagrams. Concluding description is presented on improvements to the digitally-tuned LF navigation receiver. Specifically described is the design of navigation receiver front-ends for minimum distortion with an extensive treatment of methodology and performance tradeoffs. Author (GRA)

N74-10625# Transportation Systems Center, Cambridge, Mass.
HUMAN FACTORS EXPERIMENTS FOR DATA LINK Interim Report, Aug. 1972 - Jan. 1973
Edwin H. Hilborn and Leonard R. Devanna Apr. 1973 46 p refs
(Contract DOT-IA-FA-313)
(AD-760401; TSC-FAA-73-6; FAA-RD-73-55; IR-2) Avail: NTIS CSCL 17/7

Two experiments involving the coding of Air Traffic Control messages for digital data link transmission are reported. Reaction times and error rates to slide presentations were recorded for both experiments as a means for assessing the relative meaningfulness of messages. Experiment I studied the differences between long and short abbreviations with and without spaces. The need for the use of spaces was demonstrated. Experiment 2 provided a procedural variation using the same stimulus material as that reported in Section III of Report FAA-RD-72-150, with generally comparable results. It was again determined that for short ATC messages differences in type font were not significant, that arrows were generally better than words for altitude and heading commands, that a format of three short lines was better than one extended line, and that L and R as heading commands were extremely difficult to comprehend. (Modified author abstract) GRA

N74-10626# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PASSIVE TEST PAD MODELS
Ker C. Thompson and Howard W. Kuenzler 16 Feb. 1973 83 p refs
(AD-766242; AFCRL-TR-73-0116; AFCRL-ERP-436) Avail: NTIS CSCL 17/7

Seismic modeling techniques, appropriate to the study of models of test pads for motion sensitive instrumentation, were developed. A transient Rayleigh wave study of two model pads indicated that naively-developed isolation procedures may lead to enhancement of pad motion rather than to its suppression. As a step towards the development of more sophisticated design techniques, a two-dimensional mathematical model of pad motion was developed as a computer program. The test pad designer using this program provides input information consisting of a numerical description of the proposed pad, the substrate to which it is attached, and the nature of the seismic radiation arriving in the vicinity of the test pad. The program predicts the pad

motion and, from a computer-controlled oscilloscope, can provide a 16-mm motion picture showing the magnified pad displacement as a function of time. (Modified author abstract) GRA

N74-10271* Martin Marietta Corp., Denver, Colo.
A STUDY OF ABLATOR PRODUCIBILITY AND REFURBISHMENT METHODS
William E. King, Jr. *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1972 p 585-604 (For availability see N74-10232 01-11)
CSCL 22B

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N74-10627 Michigan Univ., Ann Arbor.
A NONLINEAR ANALYSIS OF XENON-TEMPERATURE CONTROLLED REACTORS Ph.D. Thesis
Yoshiro Asahi 1972 121 p
Avail: Univ. Microfilms Order No. 73-11033

The dynamic behavior of xenon temperature controlled reactors is investigated. The main results are as follows: (1) The solutions are positive if i(0) and x(0) are nonnegative and phi (0) strictly positive. If gamma > 0, then the solutions are bounded. If gamma is positive, there are two equilibria (0,0,0) and (phi sub o, i sub o, x sub o) the shut down and steady state. The former is not attainable if phi is positive. (2) An exact relationship between the average values of phi and phi sup 2 for any periodic solution of the system is obtained. This relationship proves that the average power level of any periodic power oscillation is always less than the equilibrium power level when gamma is positive. (3) The solutions of the system are analytically constructed by means of the method of averaging. The mechanism of large oscillations following large initial perturbations in the linear stability region is analyzed.
Dissert. Abstr.

N74-10628*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER ACQUIRED PERFORMANCE DATA FROM A CHEMICALLY VAPOR-DEPOSITED-RHENIUM, NIOBIUM PLANAR DIODE
Eugene J. Manista, James F. Morris, Arthur L. Smith, and Richard B. Lancashire Washington Nov. 1973 20 p refs
(NASA-TM-X-2924; E-7543) Avail: NTIS HC $2.75 CSCL 18K

Performance data from a chemically vapor-deposited-rhenium, niobium thermionic converter are presented. The planar converter has a guard-ringed collector and a nominal fixed spacing of 0.25 mm (10 mils). The data were obtained by using a computerized acquisition system and are available on request to one of the authors on microfiche as individual and composite parametric current, voltage curves. The parameters are the temperatures of the emitter T sub E collector T sub C, and cesium reservoir T sub R. The composite plots have constant T sub E and varying T sub C or T sub R, or both. Current, voltage envelopes having constant T sub E with and without fixed T sub C appear in the present report. The diode was tested at increments between 1600 and 2000 K for the emitter Hohlraum, 800 to 1100 K for the collector, and 540 and 650 K for the reservoir. A total of 312 current, voltage curves were obtained in the present performance-evaluation. Current, voltage envelopes from three rhenium emitter converters evaluated in the present program are also given. The data are compared at commom emitter Hohlraum temperatures. Author

N74-10629*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYZING THE THERMIONIC REACTOR CRITICAL EXPERIMENTS
George F. Niederauer Washington Nov. 1973 45 p refs
(NASA-TM-X-2925; E-7517) Avail: NTIS HC $3.00 CSCL 18L

The Thermionic Reactor Critical Experiments (TRCE) consisted of fast spectrum highly enriched U-235 cores reflected by different thicknesses of beryllium or beryllium oxide with a transition zone of stainless steel between the core and reflector. The mixed fast-thermal spectrum at the core reflector interface region poses a difficult neutron transport calculation. Calculations of TRCE using ENDF/B fast spectrum data and GATHER library thermal spectrum data agreed within about 1 percent for the multiplication factor and within 6 to 8 percent for the power peaks. Use of GAM library fast spectrum data yielded larger deviations. The results were obtained from DOT R Theta calculations with leakage cross sections, by region and by group, extracted from DOT RZ calculations. Delineation of the power peaks required extraordinarily fine mesh size at the core reflector interface.
Author

N74-10630*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSPORT ANALYSIS OF MEASURED NEUTRON LEAKAGE SPECTRA FROM SPHERES AS TESTS OF EVALUATED HIGH ENERGY CROSS SECTIONS
Donald D. Bogart, Donald F. Shook, and Daniel Fieno Washington Nov. 1973 40 p refs
(NASA-TN-D-7485; E-7327) Avail: NTIS HC $3.00 CSCL 20J

Integral tests of evaluated ENDF/B high-energy cross sections have been made by comparing measured and calculated neutron leakage flux spectra from spheres of various materials. An Am-Be (alpha,n) source was used to provide fast neutrons at the center of the test spheres of Be, CH2, Pb, Nb, Mo, Ta, and W. The absolute leakage flux spectra were measured in the energy range 0.5 to 12 MeV using a calibrated NE213 liquid scintillator neutron spectrometer. Absolute calculations of the spectra were made using version 3 ENDF/B cross sections and an S sub n discrete ordinates multigroup transport code. Generally excellent agreement was obtained for Be, CH2, Pb, and Mo, and good agreement was observed for Nb although discrepancies were observed for some energy ranges. Poor comparative results, obtained for Ta and W, are attributed to unsatisfactory nonelastic cross sections. The experimental sphere leakage flux spectra are tabulated and serve as possible benchmarks for these elements against which reevaluated cross sections may be tested. Author

N74-10631# Tennessee Univ., Knoxville. Dept. of Nuclear Engineering.
APPLICATION OF ADJOINT DIFFERENCE AND SURFACE INTEGRAL METHODS TO SELECTED DEEP-PENETRATION RADIATION TRANSPORT PROBLEMS Final Report
J. C. Robinson, P. N. Stevens, and T. J. Hoffman (ORNL) Aberdeen Proving Ground, Md. Ballistic Res. Labs. Mar. 1973 49 p refs
(Contract DAAD05-71-C-0150; DA Proj. 1B0-62118-AD-52) (AD-765487; NEUT-0150-3; BRL-CR-98) Avail: NTIS CSCL 18/6

A comparison of the Surface Integral and Adjoint Difference techniques are presented in the report. The comparison is made from a brief theoretical development of each method and by the results obtained using each method for several radiation transport problems of the class of a target located in air (or air-ground interface) far removed from a point neutron source. Most targets considered thus far do not contain fissile materials; however, it is demonstrated that the calculational tools employed in this study are applicable to such targets. The theoretical considerations lead to the conclusion that an error is associated with the Surface Integral technique, but this error will probably be small for the class of problems considered herein. In contrast to this, the Adjoint Difference technique is exact. The numerical results presented agree with these predictions.
Author (GRA)

N74-10632# Naval Research Lab., Washington, D.C.
COOPERATIVE RADIATION EFFECTS SIMULATION PROGRAM Semiannual progress Report, 1 Nov. 1972 - 30 Apr. 1973
L. E. Steele and E. A. Wolicki Aug. 1973 83 p refs
(NRL Proj. M01-22)

(AD-765731; NRL-MR-2629) Avail: NTIS CSCL 18/10

The goal of the research is to provide the theoretical and experimental bases for understanding the mechanisms of void nucleation and growth and the influence of helium on both mechanical properties and void nucleation, as well as a theoretical insight into energy deposition processes. This report includes (1) an investigation of temperature-dependent effects in nickel-ion bombarded nickel, (2) comparisons of nickel-ion damage in nickel produced by a scanned-beam with that produced by a steady defocused beam, (3) the use of Jacobi polynomials to obtain a new approximation technique for transport equations, (4) investigation of the effects of cyclotron-injected helium on the fatigue properties of a TZM alloy, (5) improved facility for ion-beam irradiations, (6) a theory of the influence of minor alloy additions on void formation, (7) extension of the alpha-alpha elastic scattering technique for measuring helium concentration profiles to the study of thermal diffusion of helium, and (8) an improvement in the NRL energy deposition code E-DEP-1 and progress on a transport theory for energy deposition. (Modified author abstract) GRA

N74-10633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIOLOGICAL SHIELDING OF PROPULSION REACTOR PLANTS
D. L. Border, S. A. Kozlovskii, and V. S. Kyzyurov 6 Jun. 1973 609 p refs Transl. into ENGLISH of the mono. "Biologicheskaya Zashchita Transportnykh Reaktornykh Ustanovok" USSR, 1969
(FTD Proj. T70-02-01B)
(AD-766021; FTD-HT-23-304-73) Avail: NTIS CSCL 18/6

The report supplements a previous report with new material on shielding physics. It contains newly published data on the passage of neutrons and gamma-quanta through shielding with heterogeneities. Considerable attention is devoted to using these data for practical calculations of shielding. The sections pertaining to calculation of the yield of secondary gamma-radiation formed in the shielding and to calculations of the space-energy distributions of neutrons in various media have been expanded. GRA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N74-10634 Ohio State Univ., Columbus.
THE VISCOSITY OF DILUTE (He-3)-(He-4) MIXTURES AT LOW TEMPERATURES Ph.D. Thesis
Kenneth Alan Kuenhold 1973 137 p
Avail: Univ. Microfilms Order No. 73-18919

The viscosity of dilute solutions of He-3 in He-4 was measured at concentrations of 0.001, 0.005, 0.013, 0.027, 0.050 and 0.07 over the temperature range of 0.03 K to 0.9 K. The apparatus consisted of two reservoirs connected by a capillary tube of length 75 cm and diameter 0.028 cm. After the level in one reservoir was lowered, the flow of the mixture through the capillary was monitored with a capacitor semi-immersed in one reservoir. At 1.3% and 5% the results agree with measurements employing a vibrating wire viscometer to about 10-15% in the temperature range from 0.1 K to 0.6 K, and are in excellent agreement at lower temperatures. Measurements using the torsional crystal viscometer yield viscosities that are an order of magnitude lower at low temperatures, indicating that this method does not measure hydrodynamic viscosities of dilute solutions at low temperatures. At these same two concentrations the results are in qualitative agreement but about 20 percent lower than the theoretical calculations of Baym and Ebner. Dissert. Abstr.

N74-10635 Arizona Univ., Tucson.
THE APPLICATION OF THE DELANO y-bar y DIAGRAM TO OPTICAL DESIGN Ph.D. Thesis
Fernando Jose Lopez-Lopez 1973 212 p
Avail: Univ. Microfilms Order No. 73-19127

By using the tools of analytic geometry, all the first-order (Gaussian) properties of an optical system (magnification, cardinal points, powers and focal lengths, separations and radii of curvature, stops and pupils, vignetting, obscurations, etc.) are derived analytically. The use of vectors or complex numbers to represent the points in the diagram, not only permits more elegant derivations, but also facilitates enormously the interpretation of the diagram, and gives the reader a powerful tool for solving practical problems. This formulation is used for a general analysis of the properties of a thick element in the y- bar y diagram. An exact analytic solution to the problem of generalized bending and thickening of lenses is a direct result of this analysis. Dissert. Abstr.

N74-10636 Wayne State Univ., Detroit, Mich.
ELECTROMAGNETIC GENERATION AND ATTENUATION OF ULTRASONIC WAVES IN GALLIUM Ph.D. Thesis
Narendra Kumar Batra 1972 182 p
Avail: Univ. Microfilms Order No. 73-12477

Ultrasonic waves are generated in the RF skin depth of a metal when electromagnetic radiation falls upon its surface in the presence of a suitably oriented steady magnetic field. Using this technique, an extensive study was made of the generation efficiency of longitudinal and shear waves in gallium for various magnetic field ranges. It was found that for certain directions of RF current flow in the skin depth, with respect to the crystallographic axes, there was a very large amplitude generation peak at exactly zero magnetic field at liquid helium temperatures. A detailed study was made of the dependence of this effect upon temperature, orientation of RF current with respect to the crystallographic axes, the amplitudes of the RF driving field and static magnetic field for propagation of sound along each of the principal axes. No such zero field peak was observed in the ultrasonic attenuation. Dissert. Abstr.

N74-10637 Kansas Univ., Lawrence.
SHORT TIME EXPANSIONS OF THE AUTOCORRELATION FUNCTION FOR HEISENBERG PARAMAGNETS Ph.D. Thesis
Arthur Carl Cook 1972 111 p
Avail: Univ. Microfilms Order No. 73-11871

An attempt is made to refine the knowledge of the spin autocorrelation function for the simplest model, an infinite bravais lattice of spin magnetic moments interacting between nearest neighbor lattice sites via the Heisenberg Hamiltonian in the infinite temperature limit. Techniques are developed for application to more intractable cases. Two methods are used to approach the problem. In the first method, the energy eigenvalues and eigenvectors for finite rings of spins are used to perform an entirely numerical calculation leading to the expansion coefficients for a perturbation series expansion in time for the special case of an infinite length linear chain. The second method develops the perturbation series expansion coefficients by using a digital computer to perform a purely symbolic calculation and subsequently evaluate the algebraic results. Dissert. Abstr.

N74-10638*# Martin Marietta Corp., Denver, Colo. Space Physics Lab.
DEVELOPMENT STUDY OF THE X-RAY SCATTERING PROPERTIES OF A GROUP OF OPTICALLY POLISHED FLAT SAMPLES Phase 1 Final Report
Joseph F. Froechtenigt Jun. 1973 28 p refs
(Contract NAS5-23198)
(NASA-CR-132828; MCR-73-143) Avail: NTIS HC $3.50 CSCL 20J

A group of twelve optically polished flat samples were used to study the scattering of X-rays. The X-ray beam reflected from the twelve optical flat samples was analyzed by means of a long vacuum system of special design for these tests. The scattering measurements were made at 8.34A and 0.92 deg angle of incidence. The results for ten of the samples are comparable, the two exceptions being the fire polished samples. Author

N74-10639# Massachusetts Inst. of Tech., Cambridge.
CHANNEL MEASUREMENT RECEIVERS FOR OPTICAL COMMUNICATION Ph.D. Thesis
Richard Sennott Orr Jan. 1973 283 p refs
Avail: NTIS HC $16.25 CSCL 20E

Channel measurement receivers were investigated in the

context of uncoded digital communication through the clear turbulent atmosphere at optical frequencies. The channel fading process is assumed to be lognormal; many results for Rayleigh fading are included as well. Two optical front end processors are considered-heterodyne and direct detection. The appropriate output process models for these receivers are conditionally Gaussian and doubly stochastic Poisson, respectively. It is shown that for heterodyne receivers, an increase of at least 3 db in effective signal to noise ratio can be gained by measurement; receivers are exhibited whose performance approaches the perfect measurement bound as N increases. For direct detection lesser gains are predicted. Author

N74-10640*# Lockheed-Georgia Co., Marietta.
SOUND PROPAGATION IN AND RADIATION FROM ACOUSTICALLY LINED FLOW DUCTS: A COMPARISON OF EXPERIMENT AND THEORY
Harry E. Plumblee, Jr., Peter D. Dean, George A. Wynne, and Robert H. Burrin Washington NASA Oct. 1973 229 p refs (Contract NAS1-10472)
(NASA-CR-2306) Avail: NTIS HC $5.75 CSCL 20A

The results of an experimental and theoretical study of many of the fundamental details of sound propagation in hard wall and soft wall annular flow ducts are reported. The theory of sound propagation along such ducts and the theory for determining the complex radiation impedance of higher order modes of an annulus are outlined, and methods for generating acoustic duct modes are developed. The results of a detailed measurement program on propagation in rigid wall annular ducts with and without airflow through the duct are presented. Techniques are described for measuring cut-on frequencies, modal phase speed, and radial and annular mode shapes. The effects of flow velocity on cut-on frequencies and phase speed are measured. Comparisons are made with theoretical predictions for all of the effects studies. The two microphone method of impedance is used to measure the effects of flow on acoustic liners. A numerical study of sound propagation in annular ducts with one or both walls acoustically lined is presented. Author

N74-10641*# Hughes Research Labs., Malibu, Calif.
OPTICAL-TO-OPTICAL INTERFACE DEVICE Final Report, 1 Jul. 1971 - 30 Jun. 1972
A. D. Jacobson Feb. 1973 150 p refs
(Contract NAS5-11485)
(NASA-CR-132862) Avail: NTIS HC $9.50 CSCL 20F

Studies were conducted on the performance of a photo-activated dc liquid crystal light valve. The dc light valve is a thin film device that consists of two transparent electrodes, deposited on glass substrates, that enclose a thin film photoconductor (cadmium sulfide) and a thin layer of a nematic liquid crystal that operates in the dynamic scattering mode. The work was directed toward application of the light valve to high resolution non-coherent light to coherent light image conversion. The goal of these studies was to improve the performance and quality of the already existing dc light valve device and to evaluate quantitatively the properties and performance of the device as they relate to the coherent optical data processing application. As a result of these efforts, device sensitivity was improved by a factor of ten, device resolution was improved by a factor of three, device lifetime was improved by two-orders of magnitude, undesirable secondary liquid crystal scattering effects were eliminated, the scattering characteristics of the liquid crystal were thoroughly documented, the cosmetic quality of the devices was dramatically improved, and the performance of the device was fully documented. Author

N74-10642# Japan Broadcasting Corp., Tokyo. Advanced Television System Research Group.
PHASE GRATING TYPE LIGHT MODULATOR AND DEFLECTOR
Sizuo Tatuoka, Toshio Motoki, and Yuichi Ninomiya Jul. 1973 11 p refs
(NHK-LABS-NOTE-166) Avail: NTIS HC $3.00

The phase grating type modulator and deflector utilize the electrooptically induced periodic index change. As a result, a modulator which has a lower driving voltage and nearly the same order of driving power as the conventional one, and a deflector which has large resolvable spots, are obtained. By making use of other kinds of the crystal or other cutting directions of the crystal, this principle can be used to develop better optical components for laser application. Author

N74-10643# Institut Franco-Allemand de Recherches, St. Louis (France).
SHOCK DEPOLARIZATION OF FERROELECTRIC DOPED LEAD (ZIRCONIUM 0.95, TITANIUM 0.05) 03 TYPE CERAMICS [DEPOLARISATION SOUS CHOC DE CERAMIQUES FERROELECTRIQUES DU TYPE Pb(Zr0.95 Ti0.05)03 DOPE]
F. Bauer and K. Vollrath 28 Aug. 1972 48 p refs In FRENCH
(ISL-21/72) Avail: NTIS HC $4.50

The adiabatic depolarization of a doped ferroelectric Pb(Zr 0.95 Ti 0.05)03 was investigated. This depolarization was produced by shock waves generated by the impact of a gun launched hypervelocity projectile on a ferroelectric ceramic target. It was shown that the electric energy generated at the adaptation (0.8 J/cu cm) was inferior to the 3J/cu cm energy resulting from hydrostatic pressure adiabatic depolarization. Conditions for the optimization of electric energy recovery were studied. ESRO

N74-10644# Institut Franco-Allemand de Recherches, St. Louis (France).
HYDROSTATIC PRESSURE INDUCED PHASE CHANGE IN A FERROELECTRIC HARD MATERIAL [CHANGEMENT DE PHASE INDUIT PAR UNE PRESSION HYDROSTATIQUE DANS UN MATERIAU FERROELECTRIQUE 'DUR']
F. Bauer, P. Gonnard (Inst. Natl. des Sci. Appl.), Y. Fetiveau (Inst. Natl. des Sci. Appl.), and L. Eyraud (Inst. Natl. des Sci. Appl.) 7 Sep. 1972 14 p refs In FRENCH
(ISL-27/72) Avail: NTIS HC $3.00

Ferroelectricity into antiferroelectricity transitions induced by hydrostatic pressure in doped lead zircotitanates were investigated. The experimental equipment is described and methods of measuring transition pressure and charges liberated by the ceramics are presented. It was shown that ferroelectricity into antiferroelectricity transitions depend not only on the additive nature but also on the Zr/Ti ratio. It was concluded that studied materials are of ferroelectrical hard-type with a high remanent polarization and low permittivity; high energies are generated. The depolarization mechanism, however, is not well explained. ESRO

N74-10645# Institut Franco-Allemand de Recherches, St. Louis (France).
EXPERIMENTAL STUDY OF A HOLLOW CHARGE INTERNAL FACE BEHAVIOR AND COMPARISON WITH A THEORETICAL HYDRODYNAMICAL MODEL [ETUDE EXPERIMENTALE DU FONCTIONNEMENT INTERNE D'UNE CHARGE CREUSE ET COMPARAISON A UN MODELE THEORIQUE HYDRODYNAMIQUE]
F. Jamet and Y. deLongueville 13 Mar. 1973 58 p refs In FRENCH
(ISL-10/73) Avail: NTIS HC $5.00

The upthrust of the inner face of a hollow charge coating was studied using the flash radiography method in order to investigate the jet formation parameters. The experimental design is described and the radiographic image analyzed and processed. The inner surface coating movement was analyzed. The trajectories of matter elements were visualized and the collision conditions on the charge axis determined. These results are compared to those obtained by computation. An optical method for the visualization of upthrust was developed and compared to performance of the flash radiography method. It was concluded that this new method is particularly suitable for confined hollow charge and also in cases when the coating is too absorbing for X-rays. ESRO

N74-10646# Aerospace Corp., El Segundo, Calif.
REAL TIME INCOHERENT OPTICAL-ELECTRONIC IMAGE SUBTRACTION Technical Report, Jul. - Oct. 1972
Stephen R. Dashiell, Adolf W. Lohmann, and Jerry D. Michaelson 1 Aug. 1973 26 p refs
(Contract F04701-73-C-0074)
(AD-765547; TR-0074(4230-40)-2; SAMSO-TR-73-236) Avail:

NTIS CSCL 20/6

An image subtraction system using Ronchi grating modulation in white light and electronic bandpass filtering with a real time television output is described. Author (GRA)

N74-10647# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.

LAYING ERRORS CAUSED BY PRISM MISLEVELMENT

James V. Johnston Jun. 1973 12 p

(DA Proj. 1X2-22254-D-678)

(AD-765474; RG-73-13) Avail: NTIS CSCL 19/5

The report contains a qualitative study of the aiming errors induced by misleveling a sighting prism. This effort has been pursued to assist in the designing of several new laying systems. The principal design consideration is the orientation between the theodolite and the prism. The error generated by a mislevel prism can be additive or subtractive. This error is dependent upon the direction of rotation or mislevel of the dihedral edge of the prism with respect to the theodolite line of sight. The report shows the relationship between (1) prism rotation about a horizontal plane, (2) prism mislevel, and (3) orientation and placement of the prism and theodolite with respect to the local horizontal plane of reference, all of which affect the resulting missile azimuth error. Author (GRA)

N74-10648# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

TRANSMISSION OF 2.0 TO 3.4 MICRON INFRARED RADIATION IN ICE FOG Special Report

Harold W. OBrien and Motoi Kumai Jul. 1973 10 p refs

(DA Proj. 1T0-61102-B-52A)

(AD-766301; CRREL-SR-189) Avail: NTIS CSCL 04/2

Limited measurements are made of the transmission of infrared radiation (2.00- to 3.40-micron wavelengths) through ice fog. The experimental results are compared with the spectral transmission predicted by Mie theory for ice spheres and for water fog. The experimental measurements of attenuation by ice fog tend to agree, within the experimental error expected, with values predicted by Mie theory for ice spheres. The present studies are adversely affected by the limited state of the art making accurate measurements of ice fog concentration, and by inadequate control of environmental CO2. Author (GRA)

N74-10649# Army Missile Command, Redstone Arsenal, Ala.

MATCHED FILTERING DISCRIMINATION FOR OPTICAL CAVITY MODES

C. C. Aleksoff and B. D. Guenther 2 May 1973 56 p refs

(DA Proj. 1T0-61102-B-23A)

(AD-766708; RR-735) Avail: NTIS CSCL 20/6

Matched spatial filters are constructed for various modes of a spherical Fabry-Perot interferometer. The cross-correlation between many of these modes are obtained experimentally as well as theoretically. The orthogonality between various modes are demonstrated and used in order to discriminate against all but the desired mode. The Fabry-Perot interferometer with a zero-order mode filter could be used as a scanning interferometer over a full free range without spurious signal and over a large range of cavity spacings. Author (GRA)

N74-10650# Michigan Univ., Ann Arbor. Radiation Lab.

SECOND ORDER DIFFRACTION BY A RING DISCONTINUITY Interim Report

Eugene F. Knott and Thomas B. A. Senior Jul. 1973 76 p

(Grant AF-AFOSR-2262-72; AF Proj. 9749)

(AD-765634; Rept-011075-1-T; AFOSR-73-1237TR; SR-1) Avail: NTIS CSCL 20/6

For a ring discontinuity in slope as at the base of a right circular cone, the second order (re-) diffracted field is examined in the general case of bistatic scattering. It is shown that the ray paths are specified by a quartic equation whose solution is discussed. Selected results are presented, and an expression for the field contribution of any one such path is derived. An alternative formulation of the problem using equivalent currents leads to a compact expression of the complete second order field as a double line integral which, when evaluated by the stationary phase method, gives precisely the wide angle contributions previously obtained. However, the integral expression is also finite in the direction of the axial caustic and can be used to find the caustic matching functions in second order GTD. These take the form of complementary Fresnel integrals whose practical effectiveness is verified by a comparison of the results of a numerical evaluation of the integral with the caustically-matched expression for the field in the particular case of backscattering. Author (GRA)

N74-10651# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

MFP MAGNETIC FIELD PACKAGE: A FLEXIBLE SYSTEM OF COMPUTER PROGRAMS FOR THEORETICAL MAGNETIC FIELD CALCULATIONS

Robert E. McInerney and Arthur Abelowitz 12 Jun. 1973 51 p refs

(AF Proj. 0001)

(AD-766208; AFCRL-TR-73-0356; AFCRL-SR-161) Avail: NTIS CSCL 08/14

The report contains a description of three separate computer routines which are used to calculate various parameters utilized in the analysis of data transmitted from probes flown on research rockets and satellites. The majority of the parameters calculated are associated with magnetic field. The program contains the INVAR, FIELDG, SHELLG/FELDG routines for the calculation of magnetic field parameters. The parameters calculated by these routines are B. L, magnetic field components, geomagnetic latitude and longitude, magnetic dip latitude, invariant latitude, magnetic inclination and declination, conjugate points, geomagnetic local time, sun/shadow indicator, and geopotential altitude. (Modified author abstract) GRA

N74-10652# Army Foreign Science and Technology Center, Charlottesville, Va.

OPTICAL ELECTRONICS

D. I. Arkadev and B. M. Milinkis 3 Nov. 1972 16 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiotekhn. (Kiev), v. 26, no. 5, 1971 p 12-20

(AD-756949; FSTC-HT-23-71-73) Avail: NTIS CSCL 20/6

Optical electronics will provide an optimal solution of a series of basic problems in information technology. Increasing the output band up to 1 billion to 10 billion c/s and higher, the creation of ultra-long lines of space communication, optical location of the moon and planets, the production of optical computers with a very high operating speed: this does not exhaust the list of problems by far. Problems have already appeared that are being solved only by optical electronic means: holography, manufacture of large laser television screens, the supplying of communications between space ships in deep space, production of devices based on non-linear optics, etc. All this clearly augurs a great future for optical electronics. GRA

N74-10653# Air Force Avionics Lab., Wright-Patterson AFB, Ohio.

THE THREE PRIMARY PARAMETERS OF IMAGING SYSTEMS AND DETECTIVE QUANTUM EFFICIENCY (DQE) Final Technical Report, Jan. 1970 - Jan. 1972

Paul L. Pryor May 1973 57 p refs

(AF Proj. 7645)

(AD-766441; AFAL-TR-73-37) Avail: NTIS CSCL 17/5

A method of analyzing Imaging Sensors (independent of type of sensor, electro-optic (EO), photographic, infrared etc.) involving the concepts of Signal-to-Noise Ratio, Modulation Contrast, Resolution, Target Response Function (as related to Modulation Transfer Function (MTF) and other system and operational parameters, is presented. Equations are derived for predicting resolution as a function of object-background modulation contrast, exposure (or irradiance), and wavelength, from Detector-Display Characteristic Curve, Optical Transfer Function (or Spread Function), RMS Noise Characteristics, Path Radiance, Veiling Glare, etc. Detection and Resolution Range equations are also derived. It is recommended that the approach outlined in this report be taken when comparing sensor systems of different types. Author (GRA)

N74-10654# Naval Ship Research and Development Center, Annapolis, Md.

SOLENOID MAGNETIC FIELD CALCULATIONS FOR A NUCLEAR MAGNETIC RELAXATION FLOWMETER

Samuel H. Brown and Henry K. Whitesel Sep. 1973 27 p

refs
(AD-766448; NSRDC-27-430) Avail: NTIS CSCL 20/3

A computer program was used to find the total magnetic field strength at arbitrary points in space within a solenoid with correction coils. This solenoid configuration is designed for use in a nuclear magnetic relaxation flowmeter requiring a field homogeneity of plus or minus 0.001 gauss resolution. The computer calculations indicated that the solenoid simulated will theoretically produce a magnetic field homogeneous to plus or minus 0.001 gauss within a cylindrical region within the solenoid. This homogeneous magnetic field region is large enough to meet the requirement of the nuclear magnetic relaxation flowmeter. Computed data are also presented on a single solenoid without correction coils to show the inhomogeneity of the total field strength within an uncorrected solenoid. All of these calculations use the assumptions of perfectly homogeneous cylindrical currents and perfectly cylindrical solenoids and correction coils.

Author (GRA)

N74-10655# Texas Univ., Austin. Applied Research Labs.
NONLINEAR AIR ACOUSTICS Final Report, 1 Feb. 1971 - 31 Dec. 1972
David T. Blackstock 20 Feb. 1973 18 p refs
(Contract N00014-70-A-0166-0004; NR Proj. 386-503)
(AD-766852; ARL-TR-73-32) Avail: NTIS CSCL 20/1

Basic research on nonlinear acoustics in air was performed during calendar years 1971 and 1972. The projects described in this report are as follows: Saturation of acoustic waves; directional beams of intense sound; diffraction of N waves; focusing of N waves by a spherical mirror; propagation of intense periodic waves in a tube; propagation of finite-amplitude noise; propagation of intense acoustic signals through the earth's atmosphere; parametric acoustic array in air; and, parametric reception.

GRA

N74-10656# Oklahoma State Univ., Stillwater. Dept. of Physics.
GROWTH AND HARDENING OF ALKALI HALIDES FOR USE IN INFRARED LASER WINDOWS Annual Technical Report
William A. Sibley, Charles T. Butler, John R. Hopkins, Joel J. Martin, and Joe A. Miller 30 Apr. 1973 51 p refs
(Contract F19628-72-C-0306; ARPA Order 2055; AF Proj. 2055)
(AD-766251; AFCRL-TR-73-0342) Avail: NTIS CSCL 20/6

Several undoped and Sr doped KCl crystals were grown from reagent grade powder in a crystal puller recently placed in operation. The Sr concentration in the doped crystals was varied from a few up to 650 parts per million (ppm) molar. The engineering flow stresses or yield points of these reagent grade crystals were measured. Values obtained range from 300 psi for undoped crystals to 2550 psi for the most heavily doped crystal. These results, as well as the Vickers microhardness results, are in good agreement with measurements on crystals grown at Oak Ridge National Laboratory (ORNL) using purified powders. The flow stress of high purity KCl from ORNL is found to increase from an unirradiated value of 300 psi to 2700 psi at an electron radiation dose which has introduced a Cl(o) interstitial concentration of 65 ppm. The increase in flow stress is directly proportional to the square root of the defect concentration for both Sr doped and irradiated KCl crystals. This result is in good agreement with Fleischer's theory.

Author (GRA)

N74-10657# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. Optical Physics Lab.
A TWYMAN-GREEN ELECTRO-OPTIC LIGHT MODULATOR Interim Report
Audun Hordvik and Harvey Miller 26 Jun. 1973 13 p refs
(AF Proj. 5634)
(AD-766423; AFCRL-TR-73-0375; AFCRL-IP-191) Avail: NTIS CSCL 20/6

A Twyman-Green electro-optic light modulator using the transverse electro-optic effect in KD and P is described. Experiments have been performed at 7.1 and 40.6 MHz, and 30 percent modulation can be obtained by applying a voltage of about 40 V.

Author (GRA)

N74-10283* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MATHEMATICAL MODEL OF MOLECULAR FLOW IN THE NASA-JSC THERMAL-VACUUM CHAMBER A
A. L. Lee (Lockheed Missiles and Space Co., Huntsville, Ala.), S. J. Robertson (Lockheed Missiles and Space Co., Huntsville, Ala.), and Horst K. F. Ehlers *In its* Space Simulation, 7th 1973 p 757-773 refs (For availability see N74-10232 01-11)
CSCL 20C

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N74-10658 Maryland Univ., College Park.
A COSMOLOGICAL MODEL ILLUSTRATING PARTICLE CREATION THROUGH QUANTUM GRAVITON PRODUCTION Ph.D. Thesis
Beverly Kobre Berger 1972 229 p
Avail: Univ. Microfilms Order No. 73-9674

A spatially inhomogeneous, anisotropic, exact solution of Einstein's equations for which quantization leads to the production of gravitons from empty space is discussed. The creation of pairs of gravitons occurs in wave modes with wavelength exceeding the horizon size at an initial time. The final number of created gravitons and the cut-off mode above which no gravitons are produced depend strongly on the choice of initial time. At large times, the solution can be expressed in WKB form so that the graviton number is well defined. For the initial state an N-quantum eigenstate or randomphase mixture of eigenstates, no gravitons with wavelength shorter than the horizon size at the initial time are created. The final number of created particles in any mode is proportional to the number of unconnected regions at the initial time over the wavelength of that mode. Below the cut-off mode, the energy spectrum of the created gravitons is flat. The model considered here is a well-known Einstein-Rosen gravitational wave solution.

Dissert. Abstr.

N74-10659 Maryland Univ., College Park.
CRITICAL PHENOMENA: PERTURBATIONS, BOUNDS, AND A FIELD-THEORETICAL APPROACH Ph.D. Thesis
George VanPelt Waldo, Jr. 1972 151 p
Avail: Univ. Microfilms Order No. 73-11416

Mathematical techniques are developed to determine critical properties of a system whose inter-particle potential can be considered as a perturbation of the inter-particle potential of a system with known critical properties. Since terms in the perturbation expansion are expressed in correlation functions, it is important that these functions be studied extensively. For the general spin one-half Ising model, a set of equations and inequalities is developed for the correlation functions. These relations are used to give improved upper bounds on the critical temperature of Ising models. Another perturbation-like method based on a field-theoretical approach is studied and is found to give correct results to first order in the perturbation parameter for some systems.

Dissert. Abstr.

N74-10660# Gifu Univ. (Japan). Dept. of Physics.
AN ANALYTIC CONTINUATION OF PROPAGATORS IN A PARTICLE EXCHANGE MODEL
Masanori Kobayashi and Yukio Mori Sep. 1973 23 p refs
(DPGU-02-73) Avail: NTIS HC $3.25

From the view point that information on behavior of a desirable propagator at p sub mu = 0 is provided in the analysis of kinematical singularities at p sub mu = 0, an analytic continuation of the conventional propagator is examined under the assumption that the tracelessness property together with symmetry property survives even in the presence of interactions. By using the propagator thus obtained, the Lorentz poles in the Van Hove model are constructed and a full amplitude as a closed form summed over all the partial waves is derived. The decomposition of the propagator to lower spin states is performed by using

the orthogonal projection operators. The unitarized propagator has the correct O(4) structure at the symmetry point and yields families of J-plane poles which move with energy. Author

N74-10661*# Scientific Translation Service, Santa Barbara, Calif.
IONIZATION OF INTERNAL ELECTRON SHELLS IN NEAR-ADIABATIC COLLISIONS OF HEAVY IONS
Hans J. Specht Washington NASA Nov. 1972 45 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 185, 1965 p 301-330
(Contract NASw-2483)
(NASA-TT-F-15157) Avail: NTIS HC $4.25 CSCL 20H

A systematic investigation was carried out of the ionization of inner electron shells for all experimentally accessible collision partner combinations and projectile velocities. It was concluded that the cause of the observed fluctuations of the ionization cross section is the resonance degeneracy of the system of the two collision partners when the electronic binding energies in certain inner shells coincide. Author

N74-10662*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COLLISION QUENCHING EFFECTS IN NITROGEN AND HELIUM EXCITED BY A 30-keV ELECTRON BEAM
D. C. Lillicrap Washington Nov. 1973 19 p refs
(NASA-TM-X-2842; L-8017) Avail: NTIS HC $2.75 CSCL 20H

The quenching cross section for the 0-0 first negative band of nitrogen is determined for temperatures between 78 K and 300 K. As the temperature increases above 78 K, the quenching reaches a maximum at approximately 140 K and then decreases as 300 K is approached. At temperatures on the order of 5000 K, quenching is reported to increase with temperature and must therefore reach a minimum at some intermediate temperature between 300 K and 5000 K. By comparison, quenching of the 5016 A helium line increases continuously over the temperature range 78 K to 300 K. Author

N74-10663*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERMEDIATE ENERGY PROTON-DEUTERON ELASTIC SCATTERING
John W. Wilson Washington Nov. 1973 37 p refs
(NASA-TN-D-7313; L-8915) Avail: NTIS HC $3.00 CSCL 20I

A fully symmetrized multiple scattering series is considered for the description of proton-deuteron elastic scattering. An off-shell continuation of the experimentally known twobody amplitudes that retains the exchange symmeteries required for the calculation is presented. The one boson exchange terms of the two body amplitudes are evaluated exactly in this off-shell prescription. The first two terms of the multiple scattering series are calculated explicitly whereas multiple scattering effects are obtained as minimum variance estimates from the 146-MeV data of Postma and Wilson. The multiple scattering corrections indeed consist of low order partial waves as suggested by Sloan based on model studies with separable interactions. The Hamada-Johnston wave function is shown consistent with the data for internucleon distances greater than about 0.84 fm. Author

N74-10664# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
SURVEY OF THE PROPERTIES OF THE HYDROGEN ISOTOPES BELOW THEIR CRITICAL TEMPERATURES
H. M. Roder, G. E. Childs, R. D. McCarty, and P. E. Angerhofer Aug. 1973 121 p refs
(NBS-TN-641) Avail: SOD HC $1.25 as C13.46:641

The survey covers PVT, thermodynamic, thermal, transport, electrical radiative and mechanical properties. All isotopic as well as ortho-para modifications of hydrogen have been included. Temperatures are limited to those below the respective critical points, in general below 40 K. The pressure range is not restricted, that is solid, liquid, and gas phases are covered. However, with the exception of hydrogen, very little data exists at pressures other than saturation. The literature surveyed includes all references available to the Cryogenic Data Center up to June of 1972, and for several subjects, through March of 1973. The various properties are presented in the form of tables or graphs. Author

N74-10665# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
[RESEARCH IN NUCLEAR PHYSICS AND REACTIONS, BETA AND GAMMA SPECTROSCOPY, AND RADIO AND NUCLEAR CHEMISTRY] Progress Report, 1972 - 1973
1973 101 p refs
Avail: NTIS HC $7.25

Research is reported in the areas of nuclear physics and reactions, beta and gamma spectroscopy, in-beam spectroscopy, and radio and nuclear chemistry. The 250 to 500 MeV high duty factor linear electron accelerator is described in detail, and a list of publications is included. K.M.M.

N74-10666# Communications Research Centre, Ottawa (Ontario).
SPECTROSCOPIC STUDIES OF Nd(+3) IONS IN POCL3
A. Watanabe Sep. 1973 14 p refs
(CRC-TN-661) Avail: NTIS HC $3.00

Experimental results are reported for a spectroscopic study of Nd3(+) ions dissolved in POCl3-based aprotic solvents. The splitting of the 4F3/2 yields 4I9/2 fluorescence band in local electric fields of cubic and non-cubic symmetries is discussed. Fluorescence excitation spectra which illustrate the transfer of energy from optically pumped UO2(2+) ions to fluorescent Nd3(+) ions are shown. Author

N74-10667# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
THE MECHANICS OF STIMULATED RECOMBINATION, AND CONCEPTUAL APPLICATIONS
Saul Altshuler 30 Oct. 1973 13 p refs
(JILA-112) Avail: NTIS HC $3.00 CSCL 20H

The use of intense laser radiation to stimulate the recombination of electrons upon ions to form highly excited neutrals is studied. The results are: (1) It is possible to observe the subsequent spontaneous emission of the manufactured highly excited neutral, and (2) this technique of observing the perturbed cascade spectra can in principle measure the distribution function of the electrons. Author

N74-10668*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
MOLECULAR COLLISIONS 21: SEMICLASSICAL APPROXIMATION TO ATOM-SYMMETRIC TOP ROTATIONAL EXCITATION
Dennis Russell and C. F. Curtiss 24 Aug. 1973 23 p refs
(Grants NGL-50-002-001; NSF GP-28213A1)
(NASA-CR-135992; WIS-TCI-499) Avail: NTIS HC $3.25 CSCL 20H

A distorted wave approximation to the T matrix for atom-symmetric top scattering was developed. The approximation is correct to first order in the part of the interaction potential responsible for transitions in the component of rotational angular momentum along the symmetry axis of the top. A semiclassical expression for this T matrix is derived by assuming large values of orbital and rotational angular momentum quantum numbers. Author

N74-10669# Northeastern Univ., Boston, Mass. Dept. of Physics.
HARD MESON CURRENT ALGEBRA AMPLITUDES FOR PION-NUCLEON SCATTERING
P. Nath and S. S. Kere Aug. 1973 34 p refs Sponsored in part by NSF
(NUB-2206) Avail: NTIS HC $3.75

Pion-nucleon scattering in the low and intermediate energy region (up to 500 MeV above threshold) is determined using the hard meson current algebra method. The method is based on (a) Gell-Mann's SU(2) x SU(2) equal time current commutation relations, (b) the conserved vector current hypothesis, i.e., the CVC condition, (c) the partially conserved axial vector current hypothesis, i.e., the PCAC condition and (d) single particle saturation of intermediate states by low lying meson and nucleon resonances. The current algebra evaluations of the S-wave scattering lengths of S-wave effective ranges and P-wave scattering lengths are given and compared with all the existing

experiment. Unitarization of the current algebra amplitudes allows the determination of the phase shifts and inelasticities in the S11, S31, P11, P31, P13 and P33 channels up to 500 MeV above threshold. Excellent agreement with experiment occurs in all the channels analyzed. Extension of the techniques for analysis of higher partial waves is given. Possible future applications of off-the-mass shell amplitudes predicted by current algebra as inputs in other calculations are discussed. Author

N74-10670# Academy of Sciences (USSR), Moscow. Inst. for Space Research.
MULTIPERIPHERALISM AND HYDRODYNAMICAL THEORY OF MULTIPLE PROCESSES
Y. P. Nikitin and I. L. Rosenthal 1973 25 p refs
(PR-121) Avail: NTIS HC $3.25

A review of multiperipheralism and hydrodynamical theory of multiple processes is presented. The main properties of multiperipheralism may be deduced without resorting to the variants of the theory (resonances at vertices, multi-Regge theory or multifireball theory). Only two main postulates are required: the state of the i-th particle depends only on its two neighbors in the series; and the particle velocities are strictly ordered within the series. The latter postulate implies that the particle properties depend on the energy alone in the ultrarelativistic limit with a weak interaction character. The necessary and sufficient condition for multiperipheralism is presented in terms of the dimensionless interaction constant for 3-particle vertices in the ladder diagram. A comparison between the multiperipheral theory and the Landau hydrodynamical theory is discussed emphasizing the experimental support to the Landau theory and the absence of theoretical need for the multiperipheral theory. A set of experimental tests is proposed including the measurement of the mean ellipticity in the 10 to 100 GeV range, the determination of the total cross sections of isobar and meson resonance generation at energies near the asymptotic limit, and the composition of secondary particles for various energy values. ESRO

N74-10671# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASUREMENTS OF THE STICKING AND RECOMBINATION COEFFICIENTS OF ELECTRONS IN GASES BY THE PENETRATING-RADIATION METHOD
V. B. Brodskii and S. E. Zagik 13 Aug. 1973 17 p refs Transl. into ENGLISH from the publ. "Nizkotemperaturnaya Plazma" USSR, 1967 p 55-62
(AD-766037; FTD-HT-23-591-73) Avail: NTIS CSCL 20/9

The Russian translation details the methodology and certain results of measurements of the sticking and recombination coefficients of thermalized electrons in the region where pressure exceeds several mm Hg. The measurements were conducted by the super high-frequency method in a decaying plasma created by pulse irradiation of a gas by either electrons having an energy of about 1 MeV or gamma-quanta having energies of the same order. This method was used for measuring the dependence of the sticking coefficient of electrons in oxygen and in air and the dependence of the recombination coefficient of electrons in xenon on gas pressure. GRA

N74-10672*# Columbia Univ., New York. Radiation Lab.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM Progress Report, 1 Jul. 1972 - 30 Jun. 1973
Sven R. Hartmann and William Happer 30 Jun. 1973 160 p refs
(Grant NGL-33-008-012; Contract DAAB07-69-C-0383; Grants AF-AFOSR-2180-72; NSF GH-34407; DA Proj. 200-61102-B-31F)
(NASA-CR-136036; AD-766274; CU-6-73-0383; PR-23) Avail: NTIS HC $10.00 CSCL 07/4

The document contains reports in the fields of atomic physics, physics of molecules, resonance physics, and macroscopic quantum physics. GRA

N74-10289* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED SPATIAL UNIFORMITY OF BEAM-PLANE INTERACTION BY MEANS OF INVERSE RASTERING
Charles G. Miller *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 855-866 refs (For availability see N74-10232 01-11)
(Contract NAS7-100)
CSCL 20H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N74-10673 Wisconsin Univ., Madison.
MICROWAVE HARMONIC GENERATION IN A GASEOUS PLASMA Ph.D. Thesis
Daniel John Miley 1972 118 p
Avail: Univ. Microfilms Order No. 73-7204

A review of the literature is presented which outlines major theoretical and experimental achievements in the study of microwave harmonic generation in a plasma. An extensive bibliography is presented in chronological fashion which outlines the history of this research effort. Consideration is given to the physical conditions necessary to use impedance concepts in the consideration of a microwave discharge. The desirability of using impedance concepts is outlined by considering previous attempts at solution of the particle physics. It is shown also that for symmetrical impedances only odd harmonics can be generated in a resistive impedance and no harmonic power can be generated in a symmetrical reactance. Dissert. Abstr.

N74-10674 California Univ., Irvine.
GRAVITATIONAL AND TEARING MODE RESISTIVE PLASMA INSTABILITIES Ph.D. Thesis
Mark Alvin Cross 1972 135 p
Avail: Univ. Microfilms Order No. 73-11647

The physics is discussed of the resistive tearing mode instability of a magnetohydrodynamic sheet pinch and necessary conditions for its existence are derived. The linear growth rate, omega is then calculated by a new method in which we search for the unique value which will cause convergence of the spatial Fourier series of the perturbation. The nonlinear tearing mode is investigated by a time dependent computer solution of the Fourier transformed MHD equations, starting from the fastest growing linear mode. This method permits an assessment of the number of Fourier terms and the size of the time step required for accuracy. The effects of fluid compressibility and heating are also considered. Allowing for the limitations imposed by our closed periodic configuration, it is shown that the tearing mode could account for the energy released in solar flares on a time scale consistent with observations. Dissert.Abstr.

N74-10675 New York Univ., N.Y.
MEASUREMENTS OF THE ENERGY LOSS OF A CHARGED TEST PARTICLE BEAM IN AN EQUILIBRIUM CESIUM PLASMA Ph.D. Thesis
Irving Lee Klavan 1972 164 p
Avail: Univ. Microfilms Order No. 73-11727

Measurements were made of the energy loss of a 35 to 150 eV tenuous cesium ion beam in passage through a thermal equilibrium cesium plasma. The plasma was produced in a device developed for this experiment, through injection of cesium vapor into a hot grounded cylindrical tantalum container. The plasma was heated by radiation from two larger, ohmically heated tungsten cylinders concentric with the plasma cylinder. Plasma temperature was determined by an optical pyrometer viewing through a small hole in the plasma cylinder. Neutral density within the cylinder was determined by monitoring, with a hot wire detector, the efflux of atoms from the pyrometer observation hole. Plasma density was then calculated using the Saha equation. Energy loss measurements were made using plasma temperatures of 2100 K and 2500 K, as a function of plasma density. The data are found to be in good agreement with the theoretical predictions of Itikawa and Aono. Dissert. Abstr.

N74-10676 New York Univ., N.Y.
THE DC CONDUCTIVITY OF A PARTIALLY IONIZED CESIUM

PLASMA IN A MAGNETIC FIELD Ph.D. Thesis
Francis J. Murray 1972 110 p
Avail: Univ. Microfilms Order No. 73-11742

The dc electric conductivity tensor of a weakly ionized, homogeneous cesium plasma in near-thermodynamic equilibrium is investigated. The transverse component of the conductivity tensor, is obtained from the current voltage characteristics of the plasma cylinders and geometrical factors. Voltage versus current curves have been obtained for neutral densities from 10 to the 11th power to 10 to the 15th power particles/cu cm and for magnetic fields from 0 to 180 gauss. The measured conductivities are compared to results obtained from transport theory for a weakly ionized plasma. The predicted dependences of sigma sub t on magnetic field and neutral number density have been verified. The electron cesium atom momentum transfer cross section is estimated from the data to be (.90 plus or minus .32) x 10 to the minus 14th power sq cm.

Dissert. Abstr.

N74-10677*# Humphreys Corp., Concord, N.H.
SIMULATOR TEST TO STUDY HOT-FLOW PROBLEMS RELATED TO A GAS COOLED REACTOR
John W. Poole, Mark P. Freeman, Kenelm W. Doak, and Merle L. Thorpe Washington NASA Oct. 1973 115 p refs
(Contract NAS3-15710)
(NASA-CR-2309) Avail: NTIS HC $4.25 CSCL 18K

An advance study of materials, fuel injection, and hot flow problems related to the gas core nuclear rocket is reported. The first task was to test a previously constructed induction heated plasma GCNR simulator above 300 kW. A number of tests are reported operating in the range of 300 kW at 10,000 cps. A second simulator was designed but not constructed for cold-hot visualization studies using louvered walls. A third task was a paper investigation of practical uranium feed systems, including a detailed discussion of related problems. The last assignment resulted in two designs for plasma nozzle test devices that could be operated at 200 atm on hydrogen. Author

N74-10678*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
INITIAL RESULTS FROM THE NASA LEWIS BUMPY TORUS EXPERIMENT
J. Reece Roth, Richard W. Richardson, and Glenn A. Gerdin 1973 38 p refs Presented at Ann.-Meeting of the Plasma Phys. Div. of the Am. Phys. Soc., Philadelphia, 31 Aug. - 3 Nov. 1973
(NASA-TM-X-71468; E-7769) Avail: NTIS HC $4.00 CSCL 20I

Initial results were obtained from low power operation of the NASA Lewis Bumpy Torus experiment, in which a steady-state ion heating method based on the modified Penning discharge is applied in a bumpy torus confinement geometry. The magnet facility consists of 12 superconducting coils, each 19 cm i.d. and capable of 3.0 T, equally spaced in a toroidal array 1.52 m in major diameter. A 18 cm i.d. anode ring is located at each of the 12 midplanes and is maintained at high positive potentials by a dc power supply. Initial observations indicate electron temperatures from 10 to 150 eV, and ion kinetic temperatures from 200 eV to 1200 eV. Two modes of operation were observed, which depend on background pressure, and have different radial density profiles. Steady state neutron production was observed. The ion heating process in the bumpy torus appears to parallel closely the mechanism observed when the modified Penning discharge was operated in a simple magnetic mirror field.

Author

N74-10679# King's Coll., London (England). Dept. of Mathematics.
A THEORETICAL INVESTIGATION OF BANDED CHORUS
David Nunn 1973 57 p refs Sponsored by Sci. Res. Council
Avail: NTIS HC $5.00

Nonlinear resonant particle trajectories in wave fields consisting of an array of narrow band waves of closely spaced frequencies and wave numbers are studied. Two analogous systems, cyclotron resonance with a whistler wave field and Landau resonance with an electrostatic wave field are considered. It was found that the wave array is able to trap particles in much the same way as a single mode. Inhomogeneity plays a vital role by causing the energy of trapped particles to change.

Author (ESRO)

N74-10680# Institut Franco-Allemand de Recherches, St. Louis (France).
RUBY LASER INDUCED PHOTODETACHMENT EXPERIMENT ON NEGATIVE O2 IONS [EXPERIENCE DE PHOTODETACHEMENT SUR DES IONS O2 PAR ACTION D'UN LASER A RUBIS]
H. Fagot and B. Danner 5 Dec. 1972 24 p refs In FRENCH
(ISL-36/72) HC $3.25

In order to measure the oxygen ions in hypersonic wakes, the variation of electronic density in a gas current under the ruby laser effect was measured in a 253 MHz cavity resonator filled with polyethylene. Oxygen ions were generated in a helium electrodeless discharge after-glow. The photodetachment occurred for 10 to the 9th power electrons. A 10 to the minus 18th power/sq cm value was obtained for the experimental photodetachment cross section and agrees with the cross section of the reaction. O2(-) + h NU (694 nm) yields O2 + electron.

ESRO

N74-10681# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETOHYDRODYNAMIC METHOD OF OBTAINING ELECTRICAL ENERGY (COLLECTED ARTICLES)
V. A. Kirillina and A. E. Sheidlina 27 Apr. 1973 345 p refs Transl. into ENGLISH from the publ. "Magnitogidro Dinamicheskii Metod Poluchenia Elektroenergii" Moscow, Energiya, 1968 273 p
(AF Proj. 3144)
(AD-765933; FTD-MT-24-1737-72) Avail: NTIS CSCL 20/9

The report is a Russian translation which discusses various techniques in magnetohydrodynamics for energy conversion.

GRA

N74-10682# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPARISON OF THE EFFECTS OF DIFFERENT TRANSPORT COEFFICIENTS ON THE NONLINEAR REFLECTION AND TRANSMISSION COEFFICIENTS OF A REENTRY PLASMA
Robert J. Papa and Richard L. Taylor 8 Jun. 1973 53 p refs
(AF Proj. 5635)
(AD-766206; AFCRL-TR-73-0362; AFCRL-PSRP-551) Avail: NTIS CSCL 20/9

In a previous report, it was explained how it is desirable to maximize the amount of power that can be transmitted from a reentry vehicle by suppressing the onset of antenna voltage breakdown. Thus, the amount of high power EM radiation that can be transmitted will be greatly enhanced if electrophilic compounds are injected into the reentry flow field. A computer program has been set up and is now capable of numerically integrating Maxwell's equations coupled with the plasma transport equations. The computer code calculates the electron density profile and the plane wave transmission and reflection coefficients, as a function of incident power level for a variety of reentry flow field conditions. An implicit-explicit method is used to numerically integrate in time the coupled, nonlinear, parabolic partial differential equations. A very efficient algorithm is given for solving the coupled, tridiagonal system of equations for the electron and positive ion densities. For a typical set of reentry flow field conditions, graphs are presented of the electron density profile and the plane wave reflection and transmission coefficients for different incident power levels. The effects of varying the plasma transport coefficients are investigated in some detail. Also, the effects of varying the length of a high power pulse are investigated. Author (GRA)

N74-10683# Office of Naval Research, London (England).
CONFERENCE ON LASER PRODUCED PLASMA
Alfred E. Victor 18 Jun. 1973 20 p refs Conf. held at Hull, England, 17-18 Apr. 1973
(AD-765714; ONRL-C-16-73) Avail: NTIS CSCL 20/9

A brief review of the Conference on Laser Produced Plasmas that was held at Hull University, England (17-18 April, 1973) is given. The topics discussed were categorized into the areas of

High power lasers; Laser produced plasmas from solid targets; Gas breakdown and Laser fusion. Also included is a list of current laser and optics research projects that are being accomplished at Hull. Author (GRA)

N74-10684# Polytechnic Inst. of Brooklyn, N.Y.
RESEARCH OF AEROPHYSICS INSTITUTE FOR STRATEGIC TECHNOLOGY Semiannual Technical Summary, period ending 28 Feb. 1973
Martin H. Bloom 30 Jun. 1973 25 p
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-766222; PIBAL-73-A; AROD-8677-38-P) Avail: NTIS CSCL 20/9

The report contains a description of the technical problem areas and accomplishments achieved during the reporting period. In addition, a complete list of publications, presentations, lectures, etc. is included and the personnel associated with the program are listed. The research projects are in the general subject areas of fluid and plasma dynamics. (Modified author abstract) GRA

N74-10685# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LASERS AND THE PROBLEM OF CONTROLLED THERMONUCLEAR SYNTHESIS
N. G. Basov and O. N. Krokhin 29 Aug. 1973 13 p Transl. into ENGLISH from Budushcheye Nauki (USSR), no. 5, 1972 p 107-113
(FTD Proj. T74-01-42)
(AD-766973; FTD-HT-23-705-73) Avail: NTIS CSCL 20/9

The report reviews laser beam heating of plasmas to obtain controlled thermonuclear reactions. GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N74-10686 Tulane Univ., New Orleans, La.
A STUDY OF THE CRITICAL TEMPERATURE OF THIN ALUMINUM SUPERCONDUCTING FILMS Ph.D. Thesis
Thomas James Russell, IV 1972 93 p
Avail: Univ. Microfilms Order No. 73-12060

Thin metal films of aluminum are evaporated onto substrates of Poly(N-Vinylcarbazole) PVK, while the substrate is held at approximately 4 K. This metal film-dielectric interface was intended as a system to test for enhanced critical temperatures due to an excitonic model of superconductivity. When the critical temperatures of this system were compared to those of aluminum films on a quartz substrate it was found that the Al-PVK critical temperatures were lower than the Al-quartz critical temperatures. The critical temperatures in both cases were higher than that of bulk Al, and this enhancement could be attributed to phonon softening. No enhancement due to an excitonic pairing mechanism could be unambiguously detected. Dissert. Abstr.

N74-10687 National Lending Library for Science and Technology, Boston Spa (England).
THE PREPARATION, STRUCTURE AND VARIOUS ELECTRICAL PROPERTIES OF TITANIUM DIOXIDE FILMS
O. S. Vdovin et al Jul. 1973 18 p refs Transl. into ENGLISH from Fiz. Poluprov., Poluprov. Electron. (USSR), no. 2, 1968 p 46-56
(NLL-RTS-8238) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.70; 6 NLL photocopy coupons

The variation of the structure and electrical conductivity of titanium dioxide films with the conditions of their preparation was investigated. The films studied were prepared by the evaporation of metallic titanium and subsequent oxidation in air, by oxidation of a metallic mirror, and by evaporation of a titanium dioxide powder. The structure is tabulated for the films prepared at different temperatures of oxidation, and time of heating (hours). It was found that amorphous, anatose, or rutile films are obtained by vacuum evaporation, and that there is a strong relationship between the partial oxygen pressure and the resistance of the film. F.O.S.

N74-10688 Tennessee Univ., Knoxville.
AN ULTRASONIC INVESTIGATION OF THE MAGNITUDE AND TEMPERATURE DEPENDENCE OF THE NONLINEARITY PARAMETERS OF GERMANIUM AND FUSED SILICA Ph.D. Thesis
William Thomas Yost 1972 99 p
Avail: Univ. Microfilms Order No. 73-12452

The nonlinearity parameters of fused silica and germanium single crystals were measured as a function of temperature in the range 77 to 300 degrees Kelvin. These parameters, which are combinations of third order elastic constants, were measured by quantitatively determining the second harmonic distortion of pulsed MHz ultrasonic waves propagating through fused silica and the three principal crystallographic directions of germanium. Using a pneumatically controlled variable gap capacitive detector, it was possible to determine the low temperature values of the parameters relative to room temperature. The results indicate that for germanium the primary contributor to the third order elastic constants is a central force between nearest neighbor atoms. The forces on the fused silica atoms are found to be more complicated. The results for fused silica give a complete set of truly adiabatic third order elastic constants of a strain free sample of G.E. Type 151 fused silica. Dissert. Abstr.

N74-10689# Laboratoire de Physique Theorique et des Hautes Energies, Paris (France).
COMPUTER EXPERIMENTS ON SOLID RARE GASES: THE DYNAMICAL STRUCTURE FACTOR S (RISING Q, OMEGA) RESONANCE
Jean-Pierre Hansen and Michael L. Klein (Natl. Res. Council of Can., Ottawa) 1973 10 p refs
(LPTHE-73/25) Avail: NTIS HC $3.00

Selected results of molecular dynamics (MD) simulations of the lattice dynamics of fcc rare gas solids near the triple point and at two lower temperatures are presented and compared with recent self-consistent phonon (SCP) theories. The SCP longitudinal phonon energies were found to agree fairly well with the MD results at all temperatures. Near the triple point however SCP transverse phonon energies at high rising Q differ markedly from the MD results indicating a deficiency in current SCP theories. Author

N74-10690*# Kanner (Leo) Associates, Redwood City, Calif.
INFLUENCE OF SURROUNDINGS ON THE FREQUENCY OF AN OSCILLATING QUARTZ CRYSTAL
E. Grossmann and M. Wien Washington NASA Nov. 1973 7 p refs Transl. into ENGLISH from Phys. Zeit. (West Germany), v. 32, 1 May 1931 p 377-378
(Contract NASw-2481)
(NASA-TT-F-15159) Avail: NTIS HC $3.00 CSCL 20B

A rectangular crystal with a natural frequency of 98,100 Hz in its longitudinal mode was used in a transmitter grid circuit. A multiple ebonite disk was placed opposite the end of the crystal, and the variation in oscillator frequency was determined as a function of the distance to this reflector. Frequency was found to vary periodically with the distance in multiples of lambda/2 in air; total frequency change was about 70 Hz for small distances between crystal and plate. A similar effect was observed when the crystal was used as an acoustic receiver and a second crystal of the same frequency was placed about 25 mm from it. Frequency was again found to vary periodically in multiples of lambda/2 in air. The effect can be minimized with sound-absorbent materials, a vacuum, or hydrogen or CO2 in place of air around it. Author

N74-10691*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENT OF SURFACE STAY TIMES FOR PHYSICAL ADSORPTION OF GASES Ph.D. Thesis - Va. Univ.
Richard Gordon Wilmoth Aug. 1973 143 p refs
(NASA-TM-X-69401) Avail: NTIS HC $9.25 CSCL 20L

A molecular beam time-of-flight technique is studied as a means of determining surface stay times for physical adsorption. The experimental approach consists of pulsing a molecular beam, allowing the pulse to strike an adsorbing surface and detecting the molecular pulse after it has subsequently desorbed. The technique is also found to be useful for general studies of adsorption under nonequilibrium conditions including the study

of adsorbate-adsorbate interactions. The shape of the detected pulse is analyzed in detail for a first-order desorption process. For mean stay times, tau, less than the mean molecular transit times involved, the peak of the detected pulse is delayed by an amount approximately equal to tau. For tau much greater than these transit times, the detected pulse should decay as exp(-t/tau). However, for stay times of the order of the transit times, both the molecular speed distributions and the incident pulse duration time must be taken into account. Author

N74-10692*# National Aeronautics and Space Administration, Washington, D.C.
SOLID STATE TECHNOLOGY: A COMPILATION Technology Utilization
[1973] 33 p
(NASA-SP-5960(01)) Avail: NTIS HC $3.00 CSCL 20L

A compilation, covering selected solid state devices developed and integrated into systems by NASA to improve performance, is presented. Data are also given on device shielding in hostile radiation environments. Author

N74-10693*# Tyco Labs., Inc., Waltham, Mass.
THICK FILM SILICON GROWTH TECHNIQUES Quarterly Progress Report, 1 Jun. - 31 Aug. 1973
H. E. Bates, A. I. Mlavsky, D. N. Jewett, and V. E. White 31 Aug. 1973 28 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953365)
(NASA-CR-135977; QPR-6) Avail: NTIS HC $3.50 CSCL 20L

The research which was directed toward finding an improved die material is reported. Wetting experiments were conducted with various materials to determine their compatibility with silicon. Work has also continued toward the development of quartz as a die material as new techniques have provided more optimistic results than observed in the past. As a result of the thermal modification previously described, improvements in growth stability have contributed to an increase in ribbon quality. Author

N74-10694# Energy Conversion Devices, Inc., Troy, Mich.
RESEARCH ON THE PROPERTIES OF AMORPHOUS SEMICONDUCTORS AT HIGH TEMPERATURES Semiannual Report
John P. DeNeufville 17 Jun. 1973 85 p refs
(Contract DAHC15-70-C-0187; ARPA Order 1570)
(AD-766143; ECD-516-5; SATR-5) Avail: NTIS CSCL 20/12

The influence of illumination and annealing on thin films of amorphous As2Se3 and As2S3 has been studied through their effects on the structure and optical properties. It is shown that the dominant photostructural change in evaporated films is the polymerization of the as-deposited molecular (As4S6 or As4Se6) glass through either illumination or heating. This irreversible polymerization gives rise to a large absorption edge shift to smaller energy and to an appreciable index of refraction change. The reversible effect, called photo-darkening, is accompanied by a negligible refractive index change when compared with the irreversible polymerization change. The application of the present results to photochemical effects is discussed. (Modified author abstract) GRA

N74-10695# Boeing Aerospace Co., Seattle, Wash.
THE STRUCTURE OF NON-CRYSTALLINE MATERIALS. DETERMINATION OF LOCAL STRUCTURE IN AMORPHOUS Ge Se, GeSe2, As2 Se3, As2S3, AND As2Te USING EXAFS Semiannual Technical Report
Dale E. Sayers, Farrel W. Lytle, and Edward A. Stern (Wash. Univ., Seattle) Aug. 1973 25 p refs
(Contract DAHC04-71-C-0010; ARPA Order 1562)
(AD-766139) Avail: NTIS CSCL 20/2

Previously, it was shown that Fourier transforms of the extended X-ray absorption fine structure (EXAFS) contains information on the coordination distances and numbers about each constituent in multicomponent amorphous semiconductors. In this paper a method of analysis of the experimentally observed first coordination peak is presented which calculates the absolute number of each kind of atom which contributes to that peak. (Modified author abstract) GRA

N74-10696# Energy Conversion Devices, Inc., Troy, Mich.
RESEARCH ON THE PROPERTIES OF AMORPHOUS SEMICONDUCTORS AT HIGH TEMPERATURES Final Technical Report, 18 May 1970 - 18 May 1973
John P. DeNeufville 18 Jun. 1973 263 p refs
(Contract DAHC15-70-C-0187; ARPA Order 1570)
(AD-766141; ECD-516-6) Avail: NTIS CSCL 20/12

Research on the Properties of Amorphous Semiconductors at Elevated Temperatures is organized into three broad topics: (1) Glassy alloy studies, including both survey studies and detailed composition-property studies in a few selected systems. Much emphasis in these studies has been placed on the correlation of thermal, electrical, and optical data in understanding chemical bonding and the associated band level structure in amorphous chalcogenide alloy systems; (2) The role of deposition techniques in controlling thin film composition, structure and properties with special emphasis on the roles of argon entrapment and substrate bias during the r.f. sputter deposition of amorphous chalcogenide alloys; (3) Studies of controlled changes in conductivity, refractive index, or absorption, produced electrically, optically or thermally in Ovonic threshold and memory alloys. GRA

N74-10697# Energy Conversion Devices, Inc., Troy, Mich.
RESEARCH ON THE PROPERTIES OF AMORPHOUS SEMICONDUCTORS AT HIGH TEMPERATURES Semiannual Technical Report, 19 Dec. 1971 - 18 May 1972
John P. DeNeufville 17 Jun. 1973 108 p refs
(Contract DAHC15-70-C-0187; ARPA Order 1570)
(AD-766142; ECD-516-4; SATR-4) Avail: NTIS CSCL 20/12

Contents: Glass formation and phase separation in the GeSe-GeTe-Se-Te system; Crystallization of sputtered Ge20-Se40Te40; Electrical and optical properties of amorphous phases in the Ge-Se-Te system. GRA

N74-10698# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
DISLOCATED CELLULAR STRUCTURES
J. E. Morral and M. F. Ashby Jul. 1973 38 p refs
(Contract N00014-67-A-0298-0020; NR Proj. 031-732)
(AD-766159; TR-8) Avail: NTIS CSCL 20/12

When grains or cells form periodic structures their arrangement can contain dislocations. These defects and their movements are illustrated on lattice graphs for two and three dimensional systems. The lattice graph is topologically equivalent to the cellular structure, containing information on the number of faces, edges and corners of each cell, yet it is easier to use than the cellular structure when illustrating dislocation climb or glide. Several examples of cellular dislocation motion are described in detail and their motion is related to grain growth cell division and deformation by grain-boundary sliding. Author (GRA)

N74-10699# Arizona Univ., Tucson. Optical Sciences Center.
MODULATION SPECTROSCOPY OF DISORDERED SOLIDS Semiannual Technical Report
B. O. Seraphin and M. J. Kottke 31 Aug. 1973 24 p refs
(Grant DA-ARO(D)-31-124-73-G106)
(AD-766069; SATR-1) Avail: NTIS CSCL 07/4

The report describes research on the study of the electronic structure of disordered solids by means of modulation spectroscopy. A modulation spectrometer was assembled and calibrated. Amorphous GeTe films were chosen to initiate the investigation. Some of the previous investigations of GeTe which are applicable to the experiments are discussed. Thermoreflectance spectra were recorded at 115K in the spectral range 0.69 eV to 1.55 eV. Initial electroreflectance studies on the GeTe samples have not indicated any electromodulation of the optical constants in the range 1.55 eV to 3.54 eV. GRA

N74-10700# IBM Watson Research Center, Yorktown Heights, N.Y.
SYNTHESIS OF RARE EARTH COMPOUNDS AND STUDY OF THEIR MAGNETIC OPTICAL AND SEMICONDUCTING PROPERTIES Final Technical Report, 30 Jun. 1972 - 30 Jun. 1973
F. Holtzberg, M. W. Shafer, L. J. Tao, S. VonMolnar, J. B. Torrance, T. Penney, and T. R. McGuire Jul. 1973 25 p refs
(Contract DAAH01-71-C-1313; ARPA Order 1588; IBM Proj. 2567)

(AD-765646) Avail: NTIS CSCL 20/12

The report summarizes a three year effort in the study of the synthesis of rare earth compounds and an investigation of their magnetic, optical and semiconducting properties. The development of the growth of single crystals from the simple face centered cubic magnetic insulating rare earth chalcogenides, to the more complex Th3P4 type structures and lower symmetry layer compounds is described. Objectives include the synthesis of higher purity materials, the improvement of crystal perfection, and measurement of deviations from stoichiometry. Techniques for growing single crystals of varying compositions of solid solutions between di and trivalent rare earth chalcogenides and methods used for their characterization are developed. In addition the authors develop the reasoning which led to the variety of experiments referred to in the body of this report, with emphasis on the relationship between magnetic and electronic properties of these systems. The direct relationship of magnetism to the band structure is discussed, as reflected in transport, tunneling and optical measurements. GRA

N74-10701# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.

IMPROVEMENT OF SEMICONDUCTOR DEVICES Final Report, Jul. 1971 - Jun. 1973

James R. Black, Harold S. Gurev, and Richard W. Wilson Jul. 1973 85 p ref

(Contract DAAG39-72-C-0002; HDL Proj. 273227)

(AD-765492; HDL-002-1) Avail: NTIS CSCL 09/1

The report describes the results of six separate studies for the improvement of semiconductor devices. The subject matter of these studies are as follows: Machine Al-Ge bonding; Improved Al-Ge solder; IR production package sealing; Al-Ge die bond screen; Hunter shield; and Metallization current pulse burnout studies. GRA

N74-10702# Army Foreign Science and Technology Center, Charlottesville, Va.

ELECTRICAL PROPERTIES OF SILVER DOPED ANTIMONY TELLURIDE

J. Karimov, Sh. Mavlonov, and P. Sherov 2 Nov. 1972 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSR. Otd. Fiz.-Tekh. Khim. Mauk (Dushanbe), no. 3, 1970 p 20-25

(AD-765780; FSTC-HT-23-1005-72) Avail: NTIS CSCL 20/12

Monocrystalline specimens of Sb2Te3 were grown, alloyed with various percentages of Ag, from a melt by the Czochralski method. The temperature dependences of electric conductivity, all coefficient and thermo-emf of the specimens produced were studied in the 77-500K interval. Author (GRA)

N74-10703# Picatinny Arsenal, Dover, N.J.

ELECTROMECHANICAL SHOCK WAVES

Paul Harris Jul. 1973 26 p refs

(AD-765453; PA-TR-4532) Avail: NTIS CSCL 20/12

The existing experimental data pertaining to electromechanical shock effects in metals is reviewed. It is shown that the so called anomalous thermoelectric power experiments, and the simpler metallic sandwich experiments, are basically geometry variants of the same experiment. A theoretical model is presented which is based upon interacting electron and ion fluids. In the model each fluid is capable of supporting its own shock structure, and the shock velocity is derived for the interacting fluids under steady state conditions. The predicted shock velocity is found to be equal to a perturbed value of the shock velocity in the uncoupled ion fluid. Areas of possible future work, and a practical application of the effect, are mentioned. Author (GRA)

N74-10704# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.

STRUCTURE, PROPERTIES AND RADIATION SENSITIVITY OF ELECTRICALLY BISTABLE MATERIALS Final Report

Derek B. Dove 30 Aug. 1973 19 p

(Contract DAHC04-70-C-0024; ARPA Order 1562)

(AD-766152) Avail: NTIS CSCL 20/12

The final report includes a review of the structural and electrical work carried out on amorphous semiconducting materials under contract DAHC04-70-C-0024 and summarizes results and conclusions. Also listed are technical reports, publications, theses, and personnel who have participated in this project. Author (GRA)

N74-10705# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

ALUMINUM SILICON SCHOTTKY BARRIERS FOR GEISHA DEVICES Final Technical Report

H. W. Thompson, Jr. and Mooshi Namordi 31 Jul. 1973 144 p refs

(Contract N00014-67-A-0226-0017; NR Proj. 243-003)

(AD-766094; TR-EE73-13) Avail: NTIS CSCL 09/1

The work is undertaken to investigate the use of Schottky Barrier diodes as semiconductor targets for GEISHA type devices. A secondary purpose was to evaluate Al2O3 as a passivating insulator for use with electron-beam semiconductor targets. Schottky barriers previously fabricated for semiconductor target (ST) applications have used SiO2 as an insulating/passivation layer. Since this layer may cause undesirable ST behavior under electron bombardment, the use of unpassivated structures and those using Al2O3 passivation is investigated. Details of device fabrication and evaluation are covered, barrier heights are evaluated and methods of measurement discussed, results of the measurement of current gain are given, dynamic testing is performed under electron beam energies from 5 KeV to 30 KeV, and methods used and results obtained are described. A study is made of the interaction of 10 KeV electron with the semiconductor target. GRA

N74-10706# Maryland Univ., College Park. Engineering Materials Group.

ANALYSIS OF THERMALLY-ACTIVATED FLOW IN IRON, MOLYBDENUM AND NIOBIUM

Ronald W. Armstrong and J. Dennis Campbell (Oxford Univ.) Apr. 1973 12 p refs Submitted for publication

(Contract N00014-67-A-0239-0011; NR Proj. 031-739)

(AD-760022; EMG-124; TR-10) Avail: NTIS CSCL 20/12

The temperature and shear strain rate dependences of the flow stresses measured for single crystals or polycrystals of alpha-iron, molybdenum, and niobium are compared on the basis of the thermal activation-strain rate analysis (TASRA). Of particular concern is the TASRA parameter, the activation volume, which is shown to follow a reciprocal dependence on the thermal component of shear stress, with fair accuracy. (Author Modified Abstract) GRA

N74-10707# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE THEORY OF AN ELASTIC MEDIUM WITH MICRO-STRUCTURE

I. A. Kunin 13 Apr. 1973 14 p refs Transl. into ENGLISH from the publ. "Prochnost i Plastichnost" Moscow, Nauka, 1971 p 65-70

(AF Proj. 7351)

(AD-759859; FTD-MT-24-1568-72) Avail: NTIS CSCL 20/12

Recently, models of the mechanics of continuous media which consider the microstructure of the medium were developed. It has been shown that the moment theory of elasticity is included as the limiting case of weak dispersion in the theory of a macroscopically homogeneous elastic medium with spatial dispersion. In this article the author gives a brief survey of results of previous articles on the subject, and indicates methods for constructing effective solutions. The examination is limited to the case of a linear elastic medium. GRA

N74-10708# Lincoln Lab., Mass. Inst. of Tech., Lexington.

SOLID STATE RESEARCH, 1973:2 Quarterly Technical Summary, 1 Feb. - 30 Apr. 1973

Alan L. McWhorter 15 May 1973 68 p refs

(Contract F19628-73-C-0002; AF Proj. 649L)

(AD-766233; ESD-TR-73-100) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1973. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N74-10257* Celesco Industries, Costa Mesa, Calif.
TRANSIENT FREQUENCY EFFECTS IN PIEZOELECTRIC QUARTZ CRYSTALS CAUSED BY INCIDENT THERMAL RADIATION
D. A. Wallace *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 367-378 refs (For availability see N74-10232 01-11)
CSCL 20B

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N74-10709*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN EVALUATION OF THE RELATIVE FIRE HAZARDS OF JET A AND JET B FOR COMMERCIAL FLIGHT
Robert R. Hibbard and Paul T. Hacker Oct. 1973 30 p refs
(NASA-TM-X-71437; E-7693) Avail: NTIS HC $3.50 CSCL 21D

The relative fire hazards of Jet A and Jet B aircraft fuels are evaluated. The evaluation is based on a consideration of the presence of and/or the generation of flammable mixtures in fuel systems, the ignition characteristics, and the flame propagation rates for the two fuel types. Three distinct aircraft operating regimes where fuel type may be a factor in fire hazards are considered. These are: (1) ground handling and refueling, (2) flight, and (3) crash. The evaluation indicates that the overall fire hazards for Jet A are less than for Jet B fuel. Author

N74-10710*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ALTERNATE PROPELLANTS FOR THE SPACE SHUTTLE SOLID-ROCKET BOOSTER MOTORS
15 Oct. 1973 26 p refs
(Contract NAS7-100)
(NASA-CR-135943; JPL-TM-33-649) Avail: NTIS HC $3.50 CSCL 21I

As part of the Shuttle Exhaust Effects Panel (SEEP) program for fiscal year 1973, a limited study was performed to determine the feasibility of minimizing the environmental impact associated with the operation of the solid rocket booster motors (SRBMs) in projected space shuttle launches. Eleven hypothetical and two existing limited-experience propellants were evaluated as possible alternates to a well-proven state-of-the-art reference propellant with respect to reducing emissions of primary concern: namely, hydrogen chloride (HCl) and aluminum oxide (Al_2O_3). The study showed that it would be possible to develop a new propellant to effect a considerable reduction of HCl or Al_2O_3 emissions. At the one extreme, a 23% reduction of HCl is possible along with a 11% reduction in Al_2O_3, whereas, at the other extreme, a 75% reduction of Al_2O_3 is possible, but with a resultant 5% increase in HCl. Author

N74-10711# National Aerospace Lab., Tokyo (Japan).
ON A FAILURE CRITERION OF A SOLID PROPELLANT UNDER TRI-AXIAL STRESS FIELDS
Shuji Endoh and Kozo Kawata Mar. 1973 11 p refs In JAPANESE; ENGLISH summary
(NAL-TR-311) Avail: NTIS HC $3.00

A failure criterion of a solid propellant is developed by determining the three-dimensional stress distribution in an elastic system consisting of an elastic sphere embedded in an elastic body of infinite extent subjected to a tri-axial tension (or compression). It is assumed that the stress field under the tri-axial tension is established superimposing the stress fields each of which is produced by mutually orthogonal and independent uniaxial tension. Use is made of Sezawa and Miyazaki's solution for the case where the system is subjected to a uniaxial tension (or compression). Only the solution for the radial stress is presented, and the failure criterion of the system is established such that the matrix-filler boundary fracture of the elastic system is initiated when and where the radial stress at the boundary reaches a certain critical value. A failure surface is obtained, which is in the shape of a trihedral plane whose axis is perpendicular to the pi-plane in the tri-axial stress space. Author

N74-10712# National Aerospace Lab., Tokyo (Japan).
RELATION BETWEEN THE COMPOSITIONAL VARIABLES AND THE PRESSURE EXPONENT OF CONTROLLABLE SOLID ROCKET PROPELLANTS
Tomifumi Godai, Morio Shimizu, Katsuya Ito, Hisao Nishimura, Toshiharu Tanemura, and Tsutomu Fujiwara Apr. 1973 20 p refs In JAPANESE; ENGLISH summary
(NAL-TR-316) Avail: NTIS HC $3.00

An experimental investigation of the pressure exponent in the burning rate rule was conducted in order to find desirable propellants for controllable solid rockets. In strand and motor firings, partial replacement of ammonium perchlorate with potassium perchlorate, unimodal size distribution and finer particle size of oxidizers, lower loading fraction of binder, polybutadiene binder, and limited addition of aluminium were effective in obtaining higher pressure exponent of the composite propellants. The compositional effect on the pressure exponent was explained by combustion mechanism considerations and granular diffusion flame theory. Author

N74-10713*# Rockwell International Corp., Canoga Park, Calif.
POGO INSTABILITIES SUPPRESSION EVALUATION
E. C. Farrel and J. R. Fenwick Nov. 1973 134 p refs
(Contract NAS3-14382)
(NASA-CR-134500; R-9125) Avail: NTIS HC $8.75 CSCL 21H

A dynamic (frequency response) analysis was made of a liquid oxygen feed system consisting of a low-speed inducer, a high-speed main pump and a positive displacement pulser utilized for simulating pogo induced pressure oscillations. Based on the results of the analysis, an active control system for suppression of pulser generated pressure oscillations was designed, fabricated and tested. The test results verified that the suppressor was effective in attenuating the generated pressure oscillations over the frequency range from 10 to 30 Hz. Author

N74-10714*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
STUDY OF THERMODYNAMIC VENT AND SCREEN BAFFLE INTEGRATION FOR ORBITAL STORAGE AND TRANSFER OF LIQUID HYDROGEN Final Report, 1 Jul. 1972 - 31 Jul. 1973
E. C. Cady Aug. 1973 210 p refs
(Contract NAS3-15846)
(NASA-CR-134482; MDC-G4798) Avail: NTIS HC $12.50 CSCL 21I

A comprehensive analytical and experimental program was performed to determine the feasibility of integrating an internal thermodynamic vent system and a full wall-screen liner for the orbital storage and transfer of liquid hydrogen. Ten screens were selected from a comprehensive screen survey. The experimental study determined the screen bubble point, flow-throw pressure loss, and pressure loss along rectangular channels lined with screen on one side, for the 10 screens using LH2 saturated at 34.5 N/sq cm (50 psia). The correlated experimental data were used in an analysis to determine the optimum system characteristics in terms of minimum weight for 6 tanks ranging from 141.6 cu m (5,000 cu ft) to 1,416 cu m (50 cu ft) for orbital storage times of 30 and 300 days. Author

N74-10715# Bureau of Mines, Bartlesville, Okla.
NATURAL GAS AS AN AUTOMOTIVE FUEL, AN EXPERIMENTAL STUDY
R. D. Fleming and J. R. Allsup 1973 29 p refs
(BM-RI-7806) Avail: NTIS HC $3.50

A study was conducted to evaluate natural gas as an automotive fuel and to provide guidelines for optimum engine adjustments for low exhaust emissions. The study was conducted using a single-cylinder engine, a multicylinder engine, and a total of eight vehicles. Results from single-cylinder engine tests showed that the light-load, lean-limit misfire region for natural gas begins at an air-fuel ratio between 150 and 160 pct of stoichiometric. Changes in ignition timing significantly influenced emissions of

nitrogen oxides and hydrocarbons, but had little effect on carbon monoxide emission. Low emissions can be achieved with current-design engines by adjustment of engine parameters, but only with heavy penalty to engine performance. Emissions from vehicles fueled with natural gas are virtually unaffected by ambient temperature change within the range 20 to 100 F. Author

N74-10716# European Space Research Organization, Paris (France).
EXPERIMENTAL INVESTIGATIONS INTO THE POSSIBLE APPLICATION OF A BORON/LITHIUM SYSTEM AS A PROPELLANT COMPONENT FOR AIR AUGMENTED PROPULSION
Ro Mestwerdt et al Sep. 1973 27 p refs Transl. into ENGLISH of Exptl. Untersuch. ueber die moegliche Verwendung eines Bohr/Lithium -Systems als Treibstoffkomponente in Kombinationsantrieben, DLR-FB-73-08, DFVLR, 6 Dec. 1972
(ESRO-TT-1; DLR-Mitt-73-08) Avail: NTIS HC $3.50

A test program was carried out to investigate whether it is possible to produce a boron/lithium compound and to find out the physical, chemical and thermodynamic properties of the reaction product. Measurements for the determination of the enthalpies of reaction of the binary system were carried out at the mol ratio of Libx (x = 0.33 to 12) as well as determinations of density and quantitative analyses for mol ratios of 1.5 to 6.0. The results showed that two products were formed during the reaction, one being a solid substance and the other a loose, fine granular material, probably consisting of boron.
Author (ESRO)

N74-10717# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF ELASTOPLASTIC DEFORMATION WITH FRICTION IN HYDROCARBON MEDIA
A. F. Aksenov, P. V. Nazarenko, and A. I. Kozachenko 10 Aug. 1973 8 p refs Transl. into ENGLISH of the mono. "O Prirode Treniya Tverdykh Tel" USSR, 1971 p 38-40
(AD-765997; FTD-HT-23-42-74) Avail: NTIS CSCL 21/5

With the development of jet and turboprop engineering, the problem has arisen of increasing the antifriction and antiwear properties of fuels which, for many parts of the fuel units, are lubrication media. The Russian translation briefly studies the nature of the change in elastoplastic deformations of the surface layers of metals with friction in media consisting of jet fuels and their components. GRA

N74-10718# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
COMBINED LOADING FRACTURE TRAJECTORIES OF VISCOELASTIC MATERIALS
Stephen Alfred Marinshaw, Jr. Jun. 1973 70 p refs
(AD-765669) Avail: NTIS CSCL 19/7

The critical stress intensity factors and fracture trajectories for both filled and unfilled viscoelastic plane stress specimens were experimentally determined by controlled crack elongation. Fracture testing included combined displacement loadings both of single and bi-material specimens with initial cracks located in each material and at the bi-material interface. The feasibility of trajectory prediction using an elastic linear-strain finite-element analysis was investigated. Techniques for adapting the elastic model grid patterns to predict viscoelastic trajectories were developed. Measured trajectories correlated well with the directions of maximum principal stress as determined by the finite-element solution of a blunt crack-tip model. Author (GRA)

N74-10719# Hercules, Inc., Magna, Utah. Bacchus Works.
LIMITING AMPLITUDE ANALYSIS Final Technical Report, Aug. 1971 - Jul. 1973
Russell C. Jensen and Merrill W. Beckstead Edwards, Calif. AFRPL Jul. 1973 323 p refs
(Contract F04611-72-C-0043)
(AD-765626; AFRPL-TR-73-61) Avail: NTIS CSCL 21/9

A research program has been conducted with the objective to develop, evaluate, and verify a model for predicting the limiting amplitude of acoustic oscillations in solid rocket motors. The mathematical model used was the nonlinear oscillator model. The results of these efforts follow: Theoretical results show nonlinear particle damping and coupling of acoustic energy between acoustic modes to be significant nonlinear damping mechanisms. Results of T-burner firings using propellant seeded with inert ZrO2 particles verified the particle damping theory in that behavior predicted by theory follows the experimental frequency and diameter dependence. Also, nonlinear analyses of T-burner data showed a definite distinction between the nonlinear combustion characteristics of two propellants (SAO-101 and A-13) in terms of the quadratic nonlinear coefficient. It was possible to qualitatively explain instability behavior of a series of test motor firings. (Modified author abstract) GRA

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N74-10720*# Bell Aerospace Co., Buffalo, N.Y.
SPACE SHUTTLE RCS ENGINE Monthly Progress Report, period ending 17 Aug. 1973
22 Aug. 1973 24 p
(Contract NAS9-12996)
(NASA-CR-136021; Rept-8701-910013) Avail: NTIS HC $3.25 CSCL 21H

The design of the space shuttle RCS engine has the primary objective of reusability with minimum servicing. Engine S/N FT-2A has successfully completed all ten environmental (salt water spray, sand and dust, vibration and humidity) and hot fire cycles with no change in engine performance (steady state or pulse mode).
Author

N74-10721*# Honeywell, Inc., Minneapolis, Minn. Government and Aeronautical Products Div.
SPACE SHUTTLE MAIN ENGINE CONTROLLER ASSEMBLY, PHASE C-D Quarterly Progress Report, 28 May - 9 Sep. 1973
21 Sep. 1973 117 p
(Contract Rocketdyne-R20SPA550031; W2101)
(NASA-CR-135947; HONEYWELL-W2101-QPR-3-73; QPR-6)
Avail: NTIS HC $8.00 CSCL 21E

System design and system analysis and simulation are slightly behind schedule, while design verification testing has improved. Input/output circuit design has improved, but digital computer unit (DCU) and mechanical design continue to lag. Part procurement was impacted by delays in printed circuit board, assembly drawing releases. These are the result of problems in generating suitable printed circuit artwork for the very complex and high density multilayer boards. Author

N74-10722*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A TF30-P-3 TURBOFAN ENGINE IN AN ALTITUDE FACILITY: EFFECT OF STEADY-STATE TEMPERATURE DISTORTION
Willis M. Braithwaite Washington Nov. 1973 27 p refs
(NASA-TM-X-2921; E-7499) Avail: NTIS HC $3.00 CSCL 21E

The effects of circumferential distortion of the total temperature entering 25, 50, and 75 percent of the inlet circumferential annulus of a turbofan engine were determined. Complete compressor stall resulted from distortions of from 14 to 20 percent of the face averaged temperature. Increasing the temperature level in one sector resulted in that sector moving toward stall by decreasing the equivalent rotor speeds while the pressure ratio remained approximately constant. Stall originated as a rotating zone in the low-pressure compressor which resulted as a terminal stall in the high-pressure compressor. Decreasing the Reynolds number index to 0.25 from 0.5 reduced the required distortion for stall by 50 percent for the conditions investigated.
Author

N74-10723*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RELIABILITY AND EFFECTIVE THERMAL CONDUCTIVITY OF THREE METALLIC-CERAMIC COMPOSITE INSULATING COATINGS ON COOLED HYDROGEN-OXYGEN ROCKETS
Harold G. Price, Jr., Ralph L. Schacht, and Richard J. Quentmeyer
Washington Nov. 1973 51 p refs
(NASA-TN-D-7392; E-7461) Avail: NTIS HC $3.50 CSCL 21H

An experimental investigation of the structural integrity and effective thermal conductivity of three metallic-ceramic composite coatings was conducted. These coatings were plasma sprayed onto the combustion side of water-cooled, 12.7-centimeter throat diameter, hydrogen-oxygen rocket thrust chambers operating at 2.07 to 4.14 meganewtons per square meter chamber pressure. The metallic-ceramic composites functioned for six to 17 cycles and for as long as 213 seconds of rocket operations and could have probably provided their insulating properties for many additional cycles. The effective thermal conductivity of all the coatings was in the range of 0.7472 to 4.483 w/(m)(K), which makes the coatings a very effective thermal barrier. Photomicrographic studies of cross-sectioned coolant tubes seem to indicate that the effective thermal conductivity of the coatings is controlled by contact resistance between the particles, as a result of the spraying process, and not the thermal conductivity of the bulk materials. Author

N74-10724*# National Aeronautics and Space Administration, Washington, D.C.
LIQUID ROCKET PRESSURE REGULATORS, RELIEF VALVES, CHECK VALVES, BURST DISKS, AND EXPLOSIVE VALVES NASA Space Vehicle Design Criteria (Chemical Propulsion)
Mar. 1973 123 p refs
(NASA-SP-8080) Avail: NTIS HC $4.25 CSCL 21H

The development of and operational programs for effective use in design are presented for liquid rocket pressure regulators, relief valves, check valves, burst disks, and explosive valves. A review of the total design problem is presented, and design elements are identified which are involved in successful design. Current technology pertaining to these elements is also described. Design criteria are presented which state what rule or standard must be imposed on each essential design element to assure successful design. These criteria serve as a checklist of rules for a project manager to use in guiding a design or in assessing its adequacy. Recommended practices are included which state how to satisfy each of the criteria. Author

N74-10725*# AiResearch Mfg. Co., Phoenix, Ariz.
STUDY OF SMALL TURBOFAN ENGINES APPLICABLE TO GENERAL-AVIATION AIRCRAFT Final Report
G. L. Merrill, G. A. Burnett, C. C. Alsworth et al Sep. 1973 182 p refs
(Contract NAS2-6799)
(NASA-CR-114630; AiResearch-73-210148) Avail: NTIS HC $11.25 CSCL 21E

The applicability of small turbofan engines to general aviation aircraft is discussed. The engine and engine/airplane performance, weight, size, and cost interrelationships are examined. The effects of specific engine noise constraints are evaluated. The factors inhibiting the use of turbofan engines in general aviation aircraft are identified. Author

N74-10726*# Pratt and Whitney Aircraft, East Hartford, Conn.
IMPACT RESISTANCE OF FIBER COMPOSITE BLADES USED IN AIRCRAFT TURBINE ENGINES
L. A. Friedrich and J. L. Preston, Jr. May 1973 150 p refs
(Contract NAS3-15568)
(NASA-CR-134502; PWA-4727) Avail: NTIS HC $9.50 CSCL 21E

Resistance of advanced fiber reinforced epoxy matrix composite materials to ballistic impact was investigated as a function of impacting projectile characteristics, and composite material properties. Ballistic impact damage due to normal impacts, was classified as transverse (stress wave delamination and splitting), penetrative, or structural (gross failure). Steel projectiles were found to be > gelatin > ice projectiles in causing penetrative damage leading to reduced tensile strength. Gelatin and ice projectiles caused either transverse or structural damage, depending upon projectile mass and velocity. Improved composite transverse tensile strength, use of dispersed ply lay-ups, and inclusion of PRD-49-1 or S-glass fibers correlated with improved resistance of composite materials to transverse damage. In non-normal impacts against simulated blade shapes, the normal velocity component of the impact was used to correlate damage results with normal impact results. Stiffening the leading edge of simulated blade specimens led to reduced ballistic damage, while addition of a metallic leading edge provided nearly complete protection against 0.64 cm diameter steel, and 1.27 cm diameter ice and gelatin projectiles, and partial protection against 2.54 cm diameter projectiles of ice and gelatin. Author

N74-10727*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCESSING OF THERMIONIC POWER ON AN ELECTRICALLY PROPELLED SPACECRAFT
T. W. Macie 1 Nov. 1973 67 p refs
(Contract NAS7-100)
(NASA-CR-135941; JPL-TM-33-618) Avail: NTIS HC $5.50 CSCL 21C

A study to define the power processing equipment required between a thermionic reactor and an array of mercury-ion thrusters for a nuclear electric propulsion system is reported. Observations and recommendations that resulted from this study were: (1) the preferred thermionic-fuel-element source voltages are 23 V or higher; (2) transistor characteristics exert a strong effect on power processor mass; (3) the power processor mass could be considerably reduced should the magnetic materials that exhibit low losses at high frequencies, that have a high Curie point, and that can operate at 15 to 20 kG become avaliable; (4) electrical component packaging on the radiator could reduce the area that is sensitive to meteoroid penetration, thereby reducing the meteoroid shielding mass requirement; (5) an experimental model of the power processor design should be built and tested to verify the efficiencies, masses, and all the automatic operational aspects of the design. Author

N74-10728*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TESTING AND EVALUATION OF THE LES-6 PULSED PLASMA THRUSTER BY MEANS OF A TORSION PENDULUM SYSTEM
J. P. Hamidian and J. B. Dahlgren 1 Oct. 1973 60 p refs
(Contract NAS7-100)
(NASA-CR-135940; JPL-TM-33-630) Avail: NTIS HC $5.00 CSCL 21C

Performance characteristics of the LES-6 pulsed plasma thruster over a range of input conditions were investigated by means of a torsion pendulum system. Parameters of particular interest included the impulse bit and time average thrust (and their repeatability), specific impulse, mass ablated per discharge, specific thrust, energy per unit area, efficiency, and variation of performance with ignition command rate. Intermittency of the thruster as affected by input energy and igniter resistance were also investigated. Comparative experimental data correlation with the data presented. The results of these tests indicate that the LES-6 thruster, with some identifiable design improvements, represents an attractive reaction control thruster for attitude contol applications on long-life spacecraft requiring small metered impulse bits for precise pointing control of science instruments. Author

N74-10729*# Douglas Aircraft Co., Inc., Long Beach, Calif.
DC-9/JT8D REFAN, PHASE 1 Final Report
Nov. 1973 332 p refs
(Contract NAS3-16814)
(NASA-CR-121252; MDC-J5738) Avail: NTIS HC $18.75 CSCL 21E

Analyses and design studies were conducted on the technical and economic feasibility of installing the JT8D-109 refan engine on the DC-9 aircraft. Design criteria included minimum change to the airframe to achieve desired acoustic levels. Several acoustic configurations were studied with two selected for detailed investigations. The minimum selected acoustic treatment configuration results in an estimated aircraft weight increase of 608 kg (1,342 lb) and the maximum selected acoustic treatment configuration results in an estimated aircraft weight increase of 809 kg (1,784 lb). The range loss for the minimum and maximum

selected acoustic treatment configurations based on long range cruise at 10 668 m (35,000 ft) altitude with a typical payload of 6 804 kg (15,000 lb) amounts to 54 km (86 n. mi.) respectively. Estimated reduction in EPNL's for minimum selected treatment show 8 EPNdB at approach, 12 EPNdB for takeoff with power cutback, 15 EPNdB for takeoff without power cutback and 12 EPNdB for sideline using FAR Part 36. Little difference was estimated in EPNL between minimum and maximum treatments due to reduced performance of maximum treatment. No major technical problems were encountered in the study. The refan concept for the DC-9 appears technically feasible and economically viable at approximately $1,000,000 per airplane. An additional study of the installation of JT3D-9 refan engine on the DC-8-50/61 and DC-8-62/63 aircraft is included. Three levels of acoustic treatment were suggested for DC-8-50/61 and two levels for DC-8-62/63. Results indicate the DC-8 technically can be retrofitted with refan engines for approximately $2,500,000 per airplane. Author

N74-10730*# Mobil Research and Development Corp., Paulsboro, N.J. Research Dept.
MICROFOG LUBRICANT APPLICATION SYSTEM FOR ADVANCED TURBINE ENGINE COMPONENTS, PHASE 3 Final Report
R. J. Petrucco and S. J. Leonardi 30 Jul. 1973 129 p refs
(Contract NAS3-16729)
(NASA-CR-121271) Avail: NTIS HC $8.50 CSCL 21E

The wetting characteristics and deposit forming tendencies of a series of lubricants were evaluated using a microfog jet delivery system to wet a flat heated rotating disc. The performances of the nine lubricants are discussed in terms of the various testing parameters which include temperature, disc speed and lubricant gas flow rates. Also discussed are the heat transfer characteristics of two of the lubricants on that same plane disc specimen. The wetting characteristics and heat transfer characteristics of one of the lubricants on a complex disc simulating bearing geometry are also discussed. Author

N74-10731*# TRW Systems Group, Redondo Beach, Calif.
MARINER VENUS/MERCURY 1973 ROCKET ENGINE ASSEMBLY Final Report
D. R. Snoke and R. S. Williams 10 Nov. 1972 250 p Prepared for JPL
(Contracts NAS7-100; JPL-953361)
(NASA-CR-135979) Avail: NTIS HC $14.50 CSCL 21H

The fabrication and test of rocket engine assemblies (REA) for Mariner Venus/Mercury 1973 are reported. The fabrication, assembly and flight acceptance test of seven REA's including the type approval test of one engine and fabrication of one additional kit consisting of detail parts for an engine ready for catalyst loading are presented. The MV/M '73 REA which is a nominal 51 lbs thrust monopropellant engine is described. Under steady state operation the specific impulse is not less than 228 lb-sec at 55 lb and 218.5 lb-sec at 10 lb thrust varying linearly between these limits. The characteristic velocity is not less than 4100 ft/sec at any thrust level. Author

N74-10732*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
NASA/GE QUIET ENGINE A ACOUSTIC TEST RESULTS
S. B. Kazin and J. E. Paas Oct. 1973 209 p refs
(Contract NAS3-12430)
(NASA-CR-121175; GE-R73AEG363) Avail: NTIS HC $12.50 CSCL 21E

Eight configurations were examined to determine the effect of design/treatment variations on the engine's noise characteristics. The maximum 200-foot (61-m) sideline, perceived noise levels (PNL) for the baseline configuration, which incorporated fan frame treatment only, were 105.5 PNdB at approach and 117.9 PNdB at takeoff. With extended treatment in the fan duct, these levels were reduced to 103.0 PNdB and 110.5 PNdB. The configuration which was fully suppressed, including both fan inlet and exhaust splitters, reduced the noise further to 98.7 PNdB at approach and 110.9 PNdB at takeoff. Although Engine 'A' was not designed for actual flight application, the ground static results were projected to in-flight conditions to indicate potential reductions of landing approach and take-off noise levels for a DC8 aircraft. The projected airport community noise levels for this class of aircraft were considerably below the FAA regulations. The projected noise levels of DC8 aircraft with four fully suppressed Engines 'A' are more than 25 EPNdB below those of the current DC8 and more than 10 EPNdB below FAR Part-36. Author

N74-10733*# McDonnell-Douglas Corp., Long Beach, Calif.
DC-9/JT8D REFAN, PHASE 1 Final Report
Nov. 1973 332 p refs
(Contract NAS3-16814)
(NASA-CR-121252; MDC-J5738) Avail: NTIS HC $18.75 CSCL 21E

Analyses and design studies were conducted from August 1972 to June 1973 on the technical and economic feasibility of installing the JT8D-109 refan engine on the DC-9 aircraft. Design criteria included minimum change to the airframe to achieve desired acoustic levels. Several acoustic configurations were studied. The minimum selected acoustic treatment configuration results in an estimated aircraft weight increase of 608 kg (1,342 lb) and the maximum selected acoustic treatment configuration results in an estimated aircraft weight increase of 809 kg (1,784 lb). The range loss for the minimum and maximum selected acoustic treatment configurations based on long range cruise at 10,668 m (35,000 ft) altitude with a typical payload of 6,804 kg (15,000 lb) amounts to 54 km (86 n. mi.) respectively. Estimated reduction for minimum selected treatment show 8 EPNdB at approach, 12 EPNdB for takeoff with power cutback, 15 EPNdB for takeoff without power cutback, and 12 EPNdB for sideline. Little difference was estimated between minimum and maximum treatments due to reduced performance of maximum treatment. No major technical problems were encountered in the study. The refan concept for the DC-9 appears technically feasible and economicall viable at approximately $1,000,000 per airplane. Author

N74-10734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A SINGLE-STAGE TRANSONIC COMPRESSOR WITH A BLADE-TIP SOLIDITY OF 1.5 AND COMPARISON WITH 1.3 AND 1.7 SOLIDITY STAGES
Walter M. Osborn, Donald C. Urasek, and Royce D. Moore Washington Nov. 1973 98 p refs
(NASA-TM-X-2926; E-7255) Avail: NTIS HC $3.75 CSCL 21E

The overall and blade-element performance of a transonic compressor stage with a tip solidity of 1.5 is presented over the stable operating range at rotative speeds from 50 to 100 percent of design speed. State peak efficiency of 0.82 was obtained at a weight flow of 29.4 kg.sec (200.4 (kg/sec)/m2 of annulus area) and a pressure ratio of 1.71. Stall margin at design speed was 14 percent. A comparison of three stages in a solidity study showed that the performance of the 1.5 solidity stage and the 1.3 solidity stage were nearly identical but that the performance of the 1.7 solidity stage was significantly lower. Author

N74-10735*# Rao (G. V. R.) and Associates, Sherman Oaks, Calif.
THEORETICAL STUDIES OF TONE NOISE FROM A FAN ROTOR Final Report
G. V. R. Rao, W. T. Chu, and R. V. Digumarthi Washington NASA Nov. 1973 85 p refs
(Contract NAS2-6401)
(NASA-CR-2354) Avail: NTIS HC $3.75 CSCL 21E

An analytical study was made of some possible rotor alone noise sources of dipole, quadrapole and monopole characters which generate discrete tone noise. Particular emphasis is given to the tone noise caused by fan inlet flow distortion and turbulence. Analytical models are developed to allow prediction of absolute levels. Experimental data measured on a small scale fan is presented which indicates inlet turbulence interaction with a fan rotor can be a source of tone noise. Predicted and measured tone noise for the small scale rotor are shown to be in reasonable agreement. Author

N74-10736# Purdue Univ., Lafayette, Ind.
UNSTEADY FLUID DYNAMIC RESPONSE OF AN AXIAL-FLOW COMPRESSOR STAGE WITH DISTORTED INFLOW

John J. Adamczyk and Franklin O. Carta Jul. 1973 63 p refs Prepared in cooperation with United Aircraft Corp.
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-766084; SQUID-TR-UARL-2-PU; UARL-M91103-7) Avail: NTIS CSCL 21/5

A nonlinear, large disturbance theory has been developed which couples, interactively, the flow through the blade passages of a turbomachine blade row and an axially distorted flow field. The blade row analysis is based on the time-dependent energy equation of the flow through the passage and includes a nonlinear description of cascade loss and turning correlations from available experimental sources. The flow field analysis involves the nonlinear, time-dependent equations for the vorticity and the stream function. Coupling of the two is accomplished through the boundary conditions by mutual relationships between the pressure change across the blade row and the change in vorticity in the flow field analyses. Within the assumptions that the flow is two-dimensional and incompressible, the numerical solution is capable of predicting the influence of an upstream axial distortion on the onset of a circumferentially rotating stall pattern for a single blade row. The speed of rotation of the stall cell and the spatial attenuation of the distortion wave are also predicted, and although the observed experimental data are generally available only for multistage systems, the predicted results for the single blade row are in qualitively good agreement with the data. (Modified author abstract) GRA

N74-10737# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING PRESSURE IN COMBUSTION CHAMBER OF PULSEJET ENGINE DURING FILLING PROCESS
E. P. Polebichek and V. V. Zhdanov 16 Aug. 1973 12 p refs Transl. into ENGLISH from Saloletostroenie i Tekhn. Vozdushnogo Flota (USSR), no. 28, 1972 p 10-15
(AD-766045; FTD-HT-23-809-73) Avail: NTIS CSCL 21/5

The filling process of the combustion chamber in a pulsejet engine is studied with hydraulic losses on the valve device. A dependence is established between valve pressure loss and the main factors which determine the current process. A simple approximate formula is derived, which enables a degree of accuracy sufficient for engineering problems for determining pressure in the combustion chamber as it is being filled with a fresh working medium. GRA

N74-10738# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS). CH-54A TURBINE ENGINE Interim Report, Jan. 1964 - Dec. 1972
Aug. 1973 24 p
(AD-766228; USAAVSCOM-TR-73-18) Avail: NTIS CSCL 21/5

The report describes a value engineering analysis of a helicopter engine. Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items slected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distributions can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. Author (GRA)

N74-10739# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMIC CALCULATION OF BLADES IN AXIAL-FLOW TURBOMACHINES
Ya. A. Sirotkin 31 May 1973 614 p refs Transl. into ENGLISH of the publ. "Aerodinamicheskii Raschet Lopatok Osevykh Turbomashin" Moscow, 1972 p 1-448
(AD-765932; FTD-MT-24-1809-72) Avail: NTIS CSCL 21/5

The report discusses the direct and inverse problems of calculating the stages of axial turbine machines within the framework of the theory of cylindrical and conical stages with consideration of blockage of the flow by the blades and of the slope and curvature of the meridian lines of the current. A mathematical formulation is presented for these problems along with methods of solving them on the electronic computer and manually. GRA

N74-10740# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH TEMPERATURE COOLED GAS TURBINES (ANALYSIS AND DESIGN)
V. L. Ivanov and V. I. Lokai 11 Jun. 1973 294 p refs Transl. into ENGLISH of the publ. "Vysokotemperaturnye Okhlazhdaemye Okhlazhdaemye Gazovye Turbiny" USSR, 1971 p 1-232
(AD-766031; FTD-HC-23-1366-72) Avail: NTIS CSCL 21/5

Contents: High-temperature gas turbine engines; Heat transfer in gas turbine engine components; Cooling of gas turbine engine components; Analysis and design of cooled turbines. GRA

N74-10741# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MIXING AND COMBUSTION PROCESSES IN JET ENGINES
A. G. Prudnikov, M. S. Volynskii, and V. N. Sagalovich 5 Jul. 1973 552 p refs Transl. into ENGLISH of the publ. "Protsessy Smeseobrazovaniya i Goreniya v Vozdushno-Reaktivnyh" Moscow, 1971 p 1-356
(AD-766030; FTD-HC-23-1339-72) Avail: NTIS CSCL 21/5

The report consists of two parts. Part One is concerned principally with the physics of the interaction of droplets or solid particles with a gas stream in the presence of heat and mass exchange and with the influence of these factors on the characteristics of the engine. The problems of liquid injection (the basic parameters of the fuel-supply system and methods of measurement) are considered, dimensionless relationships are cited for spray spectra in a supersonic stream, and ranges and vaporizabilities in fuel sprays are determined. Part Two describes the process of turbulent mixing for various boundary conditions with or without evolution of heat on the basis of a consistent method of calculation; the relationships obtained can be used to calculate turbulent mixing in the cases of free jet, jet at a wall, and a jet in a nozzle. GRA

N74-10742# Stemco Mfg. Co., Longview, Tex.
TRUCK NOISE VIA DIESEL EXHAUST AND AIR INTAKE NOISE Final Report
Raymond E. Hunt, Kenneth C. Kirkland, and Stanley P. Reyle Jul. 1973 411 p refs
(Contract DOT-TSC-533)
(PB-222624/9; DOT-TSC-OST-73-12) Avail: NTIS HC $8.25 CSCL 21G

Exhaust and air intake noise was studied on five truck and bus diesel engines; the Detroit Diesel 671 and 8V-71, the Cummins NHC-250 and NTC-350, and the Mack ENDT-675. The noise source was isolated and its sound level measured at a distance of 50 feet. Detailed exhaust tests was conducted on all engines with three basic styles of exhaust systems. Each system was tested with several mufflers from different manufacturers. Sound levels without mufflers were also measured on each engine. The results of these tests are summarized and comparisons are made of exhaust systems, engines, and mufflers. Air intake noise tests were conducted with and without air cleaners installed. At least two different air cleaners were tested on each engine. A comparison is made of air intake sound levels between the engines and intake systems. A survey is made of muffler and air cleaner manufacturers to obtain information on size, price, and expected performance of the products tested. A survey on engine specifications is also included. Author (GRA)

N74-10743# General Motors Corp., Indianapolis, Ind. Diesel Allison Div.
TRANSONIC FLOW AROUND COMPRESSOR ROTOR BLADE ELEMENTS. VOLUME 1: ANALYSIS Final Report, 1 Dec. 1971 -Jun. 1973
John W. Kurzrock and Allen S. Novick Aug. 1973 91 p refs
(Contract F33615-72-C-1098; AF Proj. 3066)

(AD-766248; DDAD-EDR-7892-Vol-1; AFAPL-TR-73-69-Vol-1) Avail: NTIS CSCL 21/5

A numerical technique has been developed to obtain a solution for steady, transonic blade element flow in an axial compressor rotor of a turbomachine. Radius variation and stream surface convergence are included. The mixed-out exit conditions include shock wave losses and viscous mixing losses. The time-dependent Navier-Stokes equations in conservation law form are cast in a relative coordinate system suitable for describing rotor blade element flow. A discretized method of characteristics is used to determine the boundary conditions along the blade surface and exit plane. Steady, supersonic, uniform flow conditions are specified at upstream infinity, and periodicity is enforced on the remaining free boundaries. The hyperbolic/parabolic system of equations describing the mixed flow problem are approximated by the explicit MacCormack finite-difference scheme. The time-dependent numerical solution rapidly converges to a steady-state result. Comparisons are made with experimental data for two-dimensional cascade flows and rotor blade element flow. Author (GRA)

N74-10744# General Motors Corp., Indianapolis, Ind. Diesel Allison Div.

TRANSONIC FLOW AROUND COMPRESSOR ROTOR BLADE ELEMENTS. VOLUME 2: DIGITAL PROGRAM USER'S MANUAL Final Report, 1 Dec. 1971 - 30 Jun. 1973

John W. Kurzrock and Allen S. Novick Aug. 1973 72 p refs (Contract F33615-72-C-1098; AF Proj. 3066)

(AD-766249; DDAD-EDR-7892-Vol-2; AFAPL-TR-73-69-Vol-2) Avail: NTIS CSCL 21/5

A computer program to analyze steady-state transonic flow in turbomachinery components has been developed. The time-dependent partial differential system of equations is approximated by the MacCormack finite-difference algorithm. The program is operational for two-dimensional compressor cascades or quasi-three-dimensional rotors including radius and stream surface thickness variations. A hybrid method of characteristics is used to impose the boundary constraints upon the flow field. Flow field periodicity is used at the free surface boundaries. Output consist of a flow field description and mixed-out properties of the flow at the exit. Author (GRA)

N74-10745# United Aircraft of Canada, Ltd., Longueuil (Quebec).

LOW NOx EMISSION COMBUSTOR FOR AUTOMOBILE Final Report

H. C. Eatock, J. A. Saintsbury, P. Sampath, J. R. Keilbach, and L. J. Spadaccini Feb. 1973 259 p refs

(Contract EPA-68-04-0015)

(PB-222075/4; APTD-1457; ER-700) Avail: NTIS HC $6.75 CSCL 21E

The emission levels that could be reached by development on two combustors representing a 12:1 pressure ratio simple cycle gas turbine, and a 5:1 pressure ratio regenerative cycle gas turbine, both for automotive application were evaluated. Goals were to equal or better the EPA 1975-76 Federal Emission Standards for automobiles. Some 60 atmospheric rig tests were carried out on the simple-cycle combustor whilst 39 atmospheric rig tests were carried out on the regenerative cycle combustor. Some 430 pressure test points involving over 200 modifications to combustor geometry were run. Various fuel injection methods were employed, such as pressure atomizing, air-assisted pressure atomizing, and air-blast atomizing. For reasons of reliability and primary zone leanness, the air-blast atomizer was the final selection. The best results were obtained by the introduction of sufficient air to provide a lean head end (in the form of 3 stages of swirl) while maintaining fairly high temperatures in the intermediate zone, the remainder of the air being introduced into the dilution zone. Effects of outside parameters on combustor emissions were also evaluated. GRA

N74-10746# Northern Research and Engineering Corp., Cambridge, Mass.

LOW NOx EMISSION COMBUSTOR FOR AUTOMOBILE GAS TURBINE ENGINES

E. P. Demetri and R. J. Murad Feb. 1973 182 p refs

(Contract EPA-68-04-0017)

(PB-222340/2; APTD-1454) Avail: NTIS HC $11.25 CSCL 13B

Two research combustors were designed and tested, one of which was representative of low pressure-ratio, regenerative gas turbine cycles and the other representative of high pressure-ratio, nonregenerative cycles. The design goal was to achieve emission levels not exceeding one-half of the Federal 1957/76 emission standards. The overall aim was to develop design guidelines on the basis of detailed experimental data. Extensive modifications were made to conventional combustor configurations, but direct use was made of existing combustor design technology. Full-scale models were tested over wide ranges of operating conditions representative of typical driving cycles. Cold-flow tests were made to measure aerodynamic performance and detailed combustion tests were made to measure emission, combustion, and thermal performance. GRA

N74-10747# Chandler Evans, Inc., West Hartford, Conn.

VAPOR GENERATOR FEED PUMP FOR RANKINE CYCLE AUTOMOTIVE PROPULSION SYSTEM (CHANDLER EVANS)

R. M. Riordan Dec. 1972 213 p

(Contract EPA-68-01-0430)

(PB-222849/2; R-679-5; APTD-1357) Avail: NTIS HC $5.50 CSCL 21G

A project was undertaken to conduct comprehensive design studies pursuant to the selection of conceptual models of vapor generator feed pumps that will satisfy the performance requirement of each of three Rankine cycle automotive power systems currently under development to reduce air pollution. In pursuing the objective of providing variable output pumps for these applications, investigations were conducted of two selected courses: (1) fixed displacement pumps with variable speed drives, and (2) variable displacement pumps. The report presents a detailed summary of the project, describes the technical results, and gives conclusions. Author (GRA)

N74-10748# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF THE STRUCTURAL SHAPE AND STRESS CONCENTRATORS ON THE STRENGTH OF UNEVENLY HEATED TURBINE DISKS

M. G. Kabelevskii, I. I. Ostanchuk, and A. F. Pronkin 27 Apr. 1973 20 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 12, 1967 p 78-86

(AF Proj. 3066)

(AD-760263; FTD-HT-23-217-73) Avail: NTIS CSCL 21/5

Curves of the dependence of deformation on the time of test and revolution of failure of non-uniformly heated turbine disks of alloy EI-787 were obtained. It was shown that disks of lightened profile were deformed more and failed at lower revolutions of rotation than disks of normal profile. It was shown that the bottom of the gap on the rim, and with long-term failure - the hub of the disks should be considered the center of failure of the disks in the absence of concentrators. GRA

N74-10749# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.

TEST OF A SUPERSONIC COMPRESSOR CASCADE, VOLUME 1 Interim Report, Jul. 1971 - Aug. 1972

Robert L. Holtman, G. David Huffman, Robert B. McClure, and George T. Sinnet Wright-Patterson AFB, Ohio ARL Dec. 1972 411 p refs 2 Vol.

(Contract F33615-71-C-1766; AF Proj. 7065)

(AD-756870; ARL-72-0170-Vol-1) Avail: NTIS CSCL 21/5

The report describes in detail the experimental investigation of a stationary, linear, supersonic compressor blade cascade. The cascade incorporated contoured sidewalls to control the change in stream-tube area in the quasi-axial direction. The blades had a constant spanwise geometry. The selected blade element was from a recent compressor configuration resulting from the Aerospace Research Laboratories supersonic axial compressor research program. The investigation covered a range of inlet relative Mach numbers of 1.40 - 1.50 and a range of static pressure ratios of approximately 1.5 - 2.1. Volume 1 describes the cascade design, instrumentation, data reduction techniques, test results, and correlation of results with design characteristics. Author (GRA)

N74-10750# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
TEST OF A SUPERSONIC COMPRESSOR CASCADE, VOLUME 2 Interim Report, Jul. 1971 - Apr. 1972
Robert L. Holtman, David G. Huffman, Robert B. McClure, and George T. Sinnet Wright-Patterson AFB, Ohio ARL Dec. 1972 323 p refs 2 Vol.
(Contract F33615-71-C-1766; AF Proj. 7065)
(AD-756871; ARL-72-0170-Vol-2) Avail: NTIS CSCL 21/5

The report describes in detail the experimental investigation of a stationary, linear, supersonic compressor blade cascade. The cascade incorporated contoured sidewalls to control the change in stream-tube area in the quasi-axial direction. The blades had a constant spanwise geometry. The selected blade element was from a recent compressor configuration resulting from the Aerospace Research Laboratories supersonic axial compressor research program. The investigation covered a range of inlet relative Mach numbers of 1.40 - 1.50 and a range of static pressure ratios of approximately 1.5 - 2.1. Volume 1 describes the cascade design, instrumentation, data reduction techniques, test results, and correlation of results with design characteristics. Volume 2 describes additional work with vortex generators mounted on the blades and compares these results with the plain blade results. Author (GRA)

N74-10751# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION GAS TURBINE ENGINES (SELECTED PORTIONS)
G. S. Zhiritskii, V. I. Lokay, M. K. Maksutova, and V. A. Strunkin Nov. 1972 632 p refs Transl. into ENGLISH from the publ. "Gazovyye Turbiny Dvigateley Letatelnykh Apparatov" Moscow, Mashinostr., 1971 448 p
(AD-756810; FTD-MT-24-287-72) Avail: NTIS CSCL 21/5

The book will acquaint the reader with the working processes in gas turbines, methods of thermodynamic and gas dynamic calculation of turbines in nominal and variable modes, the system for cooling the hot portions of the turbine and its calculation, various structures, and strength calculations for the principal parts of the turbine. In addition the book gives a brief survey of designs of gas turbines. This book is a textbook for students at Aviation Technical Institutions of Higher Learning. It may also be useful to gas-turbine designers. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N74-10752 Maryland Univ., College Park.
FINE STRUCTURE IN THE SOLAR CHROMOSPHERE Ph.D. Thesis
Sou-Yang Liu 1972 125 p
Avail: Univ. Microfilms Order No. 73-11402

A set of simultaneous Ca 2 K-line spectrograms and K(2v) spectroheliograms was obtained to make an unambiguous identification of features which emit specific K-line profile shapes. In general, there are three types of profiles, double-peaked reversal, single peaked reversal, and no reversal in the central core of the K line. The profiles of plages and network fragments are always double peaked. The cell points, roundish emission features about 1500 km in size inside the network cell, emit K(2v) or K(2r) single-peaked as well as double peaked profiles. The dark regions, about 7000 km in size and also inside the network cell, show pure absorption profiles with no emission reversals at K2. In addition, there are peculiar type profiles found inside the cell. The properties of the cell points, which are best visible at K2, were determined. Dissert. Abstr.

N74-10753# National Research Council of Canada, Ottawa (Ontario).
THE ABSORPTION OF LIGHT IN INTERSTELLAR SPACE
H. Kienle 1973 44 p refs Transl. into ENGLISH from Jahr. Radioaktivitaet Electronik (W. Germany), v. 20, no. 1, 1923 p 1-46
(NRC-TT-1692) Avail: NTIS HC $4.25

The development of theories of light absorption in interstellar space is discussed along with the possibility of a medium occupying interstellar space. Three methods of light absorption are presented: dispersion, selective absorption, and general absorption. Results of studies indicate that dispersion cannot be established within the accuracy of present methods of measurement; selective absorption is indicated qualitatively, but not proven; general absorption is present in only very small amounts; and the absorbing medium comprises nonluminous masses of gas and dark dust clouds, irregularly distributed. A bibliography of works advancing these theories is included. K.M.M.

N74-10754*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR ENERGY TO MEET THE NATION'S ENERGY NEEDS
Frank E. Rom and Ronald L. Thomas 1973 26 p refs Presented at Energy Facts for Concerned Citizens: A Natl. Forum, Boise, Idaho, 26-27 Apr. 1973
(NASA-TM-X-68290; E-7625) Avail: NTIS HC $3.50 CSCL 10A

Solar energy, being a non-depleting clean source of energy, is shown to be capable of providing energy in all the forms in which it is used today. It can be used to generate electricity, for heating and cooling buildings, and for producing clean renewable gaseous, liquid and solid fuel. There is little question of the technical feasibility for utilizing solar energy. The chief problem is rapidly providing innovative solutions that are economically competititive with other systems. Author

N74-10755*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CORRELATIVE STUDY OF SSC'S, INTERPLANETARY SHOCKS, AND SOLAR ACTIVITY
J. K. Chao and R. P. Lepping Oct. 1973 42 p refs Presented at conference on Flare-produced Shock Waves in the Corona and Interplanetary Space, Boulder, Colo., 11-14 Sep. 1972 Submitted for publication
(NASA-TM-X-70499; X-692-73-322) Avail: NTIS HC $4.25 CSCL 03B

A total of 93 SSC's were examined during the four year period from 1968 to 1971 at and near the peak of the solar activity cycle. Of the 93 SSC's 81 could be associated with solar activity, such as solar flares and radio bursts of Type II and Type IV. The mean propagation speeds of these flare-associated events ranged from 400 to 1000 km/sec with an average speed of 600-700 km/sec. Disturbances associated with 48 of the SSC's have been studied in detail using the corresponding interplanetary (IP) magnetic field, and plasma data when they were available. It was found that 41 of the 48 disturbances corresponded to IP shock waves, and the remaining seven events were tangential discontinuities. Thirty percent of the IP shocks had thick structure (i.e. the magnetic field jump across the shock occurred over a distance much greater than 50 proton Larmor radii). Also given is a statistical study of the gross geometry of a typical or average shock surface based on multiple spacecraft sightings and their relative orientation with respect to the solar flare. It is suggested that a typical shock front propagating out from the sun at I AU has a radius of curvature on the order of I AU. Also given are some general properties of oblique IP flare-shocks. Author

N74-10756# International Geophysical Year World Data Center A, Asheville, N.C.
CATALOGUE OF DATA ON SOLAR-TERRESTRIAL PHYSICS IN WORLD DATA CENTER A SUBCENTERS
Environmental Data Service Oct. 1973 326 p refs Supersedes UAG-20 Sponsored by NOAA
(UAG-30; UAG-20) Avail: NTIS MF $1.45; National Climatic Center, Federal Building, Asheville, N. C. 28801. Attn: Publications HC $1.75 CSCL 03B

This catalogue presents the holdings in solar-terrestrial physics at the two World Data Center A subcenters concerned with these disciplines: WDC-A for solar-terrestrial physics, Boulder, Colorado; and WDC-A, rockets and satellites, Greenbelt, Md. Data are provided for the following areas: (1) solar and

interplanetary phenomena; (2) ionospheric phenomena; (3) flare-associated events; (4) geomagnetic phenomena; (5) auroras; (6) cosmic rays; and (7) airglow. A.L.

N74-10757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY BURSTS DURING NEUTRON STAR FORMATION. GAMMA-RAY BURSTS AND TRANSIENT X-RAY SOURCES
Jeffrey M. Cohen, U. D. Desai, and S. S. Holt Oct. 1973 7 p refs Submitted for publication
(NASA-TM-X-70510; X-660-73-326) Avail: NTIS HC $3.00 CSCL 03B

Discussions are presented of the associations between cosmic gamma ray bursts and transient X-ray sources, and the release of gravitational binding energy during the formation of neutron stars. The model for studying the associations is described along with the release of neutrinos during the collapse of white dwarfs. F.O.S.

N74-10758*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR PROTON FLUENCES AS OBSERVED DURING 1966-1972 AND AS PREDICTED FOR 1977-1983 SPACE MISSIONS
Joseph H. King Nov. 1973 46 p refs Submitted for publication
(NASA-TM-X-70508; X-601-73-324) Avail: NTIS HC $4.50 CSCL 03B

The probability with which any given proton fluence level will be exceeded during a space mission is computed for missions to be flown during the active phase of the next solar cycle (1977-1983). This probability is a function of fluence level, proton energy threshold, and mission duration. Data on the major solar proton events of 1966-1972 are given; it is argued that only this data set (and not that of the previous solar cycle) is appropriate for estimating next-cycle fluences. Probable numbers of each of the two types of events are estimated from Burrell's extension of Poisson statistics. Fluences of all future anomalously large events are assumed to have a common spectrum, that given by the August 1972 event. Fluences of the ordinary events are assumed to obey a log normal distribution. It is shown that for much of the confidence-level mission-duration regime of interest, at least one anomalously large event will occur; and given such an occurrence, the ordinary-event contribution to mission fluence is negligible. Author

N74-10759*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIATION HAZARDS TO SYNCHRONOUS SATELLITES: THE IUE (SAS-D) MISSION
E. G. Stassinopoulos Sep. 1973 245 p refs
(NASA-TM-X-70501; X-601-73-330) Avail: NTIS HC $14.25 CSCL 03B

The ambient trapped particle fluxes incident on the IUE (SAS-D) satellite were studied. Several synchronous elliptical and circular flight paths were evaluated and the effect of inclination, eccentricity, and parking longitude on vehicle encountered intensities was investigated. Temporal variations in the electron environment were considered and partially accounted for. Magnetic field calculations were performed with a current field model extrapolated to a later epoch with linear time terms. Orbital flux integrations were performed with the latest proton and electron environment models using new improved computational methods. The results are presented in graphical and tabular form; they are analyzed, explained, and discussed. Estimates of energetic solar proton fluxes are given for a one year mission at selected integral energies ranging from 10 to 100 MeV, calculated for a year of maximum solar activity during the next solar cycle. Author

N74-10760*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC SOFT GAMMA-RAY BURSTS AND THE STELLAR SUPER-FLARE HYPOTHESIS
F. W. Stecker and K. J. Frost Nov. 1973 14 p refs Presented at the conference on Transient Cosmic Gamma-Ray and X-Ray Sources, Los Alamos, N. Mex., 20-21 Sep. 1971
(NASA-TM-X-70513; X-641-73-333) Avail: NTIS HC $3.00 CSCL 03B

Cosmic soft gamma ray bursts are discussed, and the stellar super-flare hypothesis is supported. Previous predictions and observations of gamma ray bursts are cited. Studies show that it is plausible that the bursts are caused by the bremsstrahlung of electrons accelerated to high energies in a stellar flare event. Possible observational consequences are listed for the stellar flare hypothesis. K.M.M.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N74-10761 Wisconsin Univ., Madison.
COLLECTIVE EXCITATIONS IN SMALL SOLID PARTICLES AND ASTRONOMICAL APPLICATIONS Ph.D. Thesis
Daya Prakash Gilra 1972 127 p
Avail: Univ. Microfilms Order No. 73-7188

The primary aims of this investigation are: (1) to investigate the natural or intrinsic absorption and scattering properties of small particles of real substances, and (2) to use these results as diagnostic tools to investigate the nature of interstellar and circumstellar solid particles. Strong resonances in absorption and scattering occur in the spectral regions in which the real part of the dielectric constant is negative. Broadly speaking, the processes giving rise to these resonances are characterized as collective excitations. Electrostatic modes of oscillation are discussed in detail, especially for spheroidal particles having anisotropic optical properties. Starting from Debye's conditions for electromagnetic modes in spherical particles two types of modes are discussed: surface modes, which occur in the spectral regions in which the dielectric constant is negative; and bulk modes, which occur on the lower energy side of the peak in Epsilon sub 2. Dissert. Abstr.

N74-10762 Ohio State Univ., Columbus.
FILAMENTARY STRUCTURE IN PLANETARY NEBULAE Ph.D. Thesis
Gregory Orth Boeshaar 1972 116 p
Avail: Univ. Microfilms Order No. 73-11456

The filamentary structure of planetary nebulae was studied by means of photographic spectrophotometry in order to determine the characteristics of these features with respect to the ambient nebular gas. Untrailed spectrograms covering a wavelength range of Lambda 4800 to Lambda 7400 were obtained for eight planetaries (IC 418, NGC 2392, NGC 2440, NGC 3242, NGC 3587 NGC 6543, NGC 6720, and NGC 6826) and microphotometer traces of these spectrograms were done in two modes. First, tracings of selected emission lines were made perpendicular to the wavelength dispersion. These yielded relative intensity vs. angular position contours of the nebulae for each line. Second, short slit traces along the dispersion were used to produce sets of relative emission line fluxes for the filaments and for the ambient gas. From these emission line fluxes, electron densities and temperatures were determined for the nebular regions studied. Dissert. Abstr.

N74-10763 New York Univ., N.Y.
THE INTERSTELLAR LINE SPECTRA OF ZETA OPHIUCHI AND ZETA PERSEI AND THEIR RELATION TO THE SHORT WAVELENGTH AND MICROWAVE BACKGROUND RADIATION Ph.D. Thesis
Victor John Bortolot 1972 123 p
Avail: Univ. Microfilms Order No. 73-11675

Thirty-one high dispersion coude spectrograms of zeta Oph and seven of zeta Per were numerically synthesized to produce high resolution, low noise spectra in the interval lambda lambda 3650 to 4350 A that yield more accurate data on atomic and molecular absorption in well defined regions of the interstellar medium. The detection threshold is improved by as much as a factor of 5 over single plates. Several new interstellar lines were

discovered in the zeta Oph -15 km/sec cloud and the zeta Per 13 km/sec cloud. Also c-13H(±) lambda 4232 A and K I lambda lambda 4043 and 4047 were seen in zeta Oph for the first time anywhere in the interstellar medium, and the previously observed Ca I lambda 4227 A and Fe I lambda lambda 3720 and 3860 A for the first time in both zeta Oph and zeta Per. Dissert. Abstr.

N74-10764 New Mexico State Univ., Las Cruces.
OBSERVATIONS OF ATMOSPHERIC LIMB DARKENING IN THE VISUAL CONTINUUM AND AN ANALYSIS OF MULTIPLE SCATTERING IN THE ATMOSPHERES OF JUPITER AND SATURN Ph.D. Thesis
Bradford A. Smith 1972 180 p
Avail: Univ. Microfilms Order No. 73-10372

Atmospheric limb darkening of optically homogeneous belts and zones on Jupiter and Saturn was measured in the visual continuum over a range of spectral passbands and phase angles for the years 1969-1971. Both Jupiter and Saturn exhibited surface brightness distributions that were consistent with anisotropic scattering in a semi-infinite cloud layer, but the observations also suggest the presence of an optically thin layer of small particles overlying the dense cloud surface on Saturn. The shape of the scattering indicatrix of particles in the Jovian cloud surface in 1971 varied only slightly from place to place and, in general, indicated slightly forward scattering. The observed variations were unrelated to color or albedo. In the shorter wavelengths only, the cloud particles in both the Northern and Southern Hemispheres of Jupiter in 1969 showed backscattering characteristics. Dissert. Abstr.

N74-10765 Michigan Univ., Ann Arbor.
THE TEMPERATURE DISTRIBUTION IN M8 AS DETERMINED FROM THE LINE INTENSITY RATIO OF H ALPHA AND NII (LAMBDA 6584 A) Ph.D. Thesis
Paul Swegman Hoover 1972 103 p
Avail: Univ. Microfilms Order No. 73-11151

The diffuse nebula, M8 was observed photographically in the emission lines, H alpha and Npi(lambda 6584A). Interference filters of approximately 20 A bandpass were used to isolate these lines. Three plates were obtained in each line with a range of exposure of one to nine. These plates were scanned with a resolution of 5 sec of arc and scans of the three plates in each line were averaged, giving usable relative intensities over most of M8. Contours of equal temperature are roughly circular and are centered on or near to the hourglass nebula and the 07 star Herschel 36. The temperature gradient is quite smooth and falls from peak values of about 11000 K near Herschel 36, to approximately 5000 K 15 pc from the hourglass region. Beyond 15 pc, the temperature rises again, but the Npi intensity is too low to consider this result reliable. Dissert. Abstr.

N74-10766 Michigan Univ., Ann Arbor.
A RADIO SOURCE SURVEY AT 8000 MHz: THE NUMBER, SPECTRA AND VARIABILITY OF EXTRAGALACTIC SOURCES Ph.D. Thesis
George William Brandie 1972 139 p
Avail: Univ. Microfilms Order No. 73-11049

An areal survey was conducted at a frequency of 8000 MHz using the University of Michigan 85-foot radio telescope. This survey was undertaken to obtain an unbiased sample of the population of extragalactic sources at 8000 MHz. Fifty-six sources were found by the survey in an area of 0.8 steradian; five of these are newly discovered sources. The counts of sources were analyzed using the maximum likelihood method. The number of sources per steradian with flux densities greater than or equal to S was found. The surface density of sources at 8000 MHz is 1.5 + or - 0.7 times the number expected from a linear extrapolation of lower frequency observations. Sources stronger than 0.1 flux unit do not make a significant contribution to the cosmic background radiation at 8000 MHz. Dissert. Abstr.

N74-10767 Washington Univ., St. Louis, Mo.
APOLLO 14 RARE GASES. Pu-244 XENON PhjD. Thesis
Don P. Ragan 1972 240 p
Avail: Univ. Microfilms Order No. 73-5057

The first results of rare gas measurements on the recently constructed mass spectrometer facility are reported. Four stepwise temperature extractions were made on Apollo 14 samples 14306-light, 14306-dark, 14301 and 14311. Neon, argon, krypton, and xenon data are reported. Analysis of xenon in 14301 shows a large enrichment of the heavy isotopes due to the decay of now extinct Pu-244. The separation of the fission gas from the spallation gas in the different temperature fractions allowed a measurement of the fission xenon yield spectrum. Computations on the spallation spectrum in the rocks were made. Evidence for more than one component in a rock was observed in 14301 and 14311. The spectrometer used to measure the gases is described in detail. Two features, original with this spectrometer, are the automatic data acquisition system and the peak jumping (switching) hardware. These two technical improvements are also discussed in full. Dissert. Abstr.

N74-10768*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SATELLITE-TRACKING AND EARTH-DYNAMICS RESEARCH PROGRAMS Semiannual Progress Report, 1 Jul. - 31 Dec. 1972
31 Dec. 1972 28 p
(Grant NGR-09-015-002)
(NASA-CR-135839; SAPR-27) Avail: NTIS HC $3.50 CSCL 22C

Satellite tracking and earth dynamics research programs are discussed. Geodetic and geophysical investigations are reported along with atmospheric research using satellite drag data. Satellite tracking network functions and support groups which are discussed include: network operations, communications, data-services division, moonwatch, and programming group. K.M.M.

N74-10769*# Yale Univ., New Haven, Conn.
LUNAR THERMAL MEASUREMENTS IN CONJUNCTION WITH PROJECT APOLLO Final Report
Sydney P. Clark, Jr. Sep. 1973 161 p refs
(Grant NGR-07-004-039)
(NASA-CR-136035) Avail: NTIS HC $10.25 CSCL 03B

Problems related to the feasibility of measuring lunar heat flow at the lunar surface are analyzed, and the findings which required that a drill be developed for lunar use are discussed. Numerical simulations were made of the in situ measurement of lunar thermal conductivity using a circular ring source of heat. The results of these simulations formed the basis for the criteria used in designing a subsurface thermal probe for ALSEP. Preliminary analyses are presented on the data obtained from the Apollo 15 and 17 missions. Author

N74-10770*# Texas Univ., Dallas.
STUDIES RELATED TO THE EVOLUTION OF THE LUNAR SOIL MATERIALS Progress Report
J. L. Carter 31 Jul. 1973 113 p refs
(Grant NGR-44-004-116)
(NASA-CR-136020) Avail: NTIS HC $7.75 CSCL 03B

Studies of the chemistry and morphology of the lunar samples are reported. The presence of fragments of plagoclase in the centers of the impact craters indicate that the glass spheres were derived by meteoritic impact from high velocity particles, while the glass was at high temperatures. From the study of the Apollo 16 samples, it is suggested that this material was formed in a hot impact ejecta blanket, or in an igneous environment, and later exposed to meteoritic impact. It is suggested that particles from Apollo 17 were formed in a cloud of siliceous vapors. F.O.S.

N74-10771*# Techtran Corp., Glen Burnie, Md.
BILLIONS INTO ORBIT. THE DISMAL BALANCE SHEET OF EUROPEAN SPACE ACTIVITIES
Rolf Rothmayer Washington NASA Nov. 1973 5 p Transl. into ENGLISH of the publ. "Milliarden auf Umlaufbahn. Die Traurige Bilanzder Europaeischen Raumfahrtaktivitaeten' West Germany, Die Presse, 19 Aug. 1973 p 3
(Contract NASw-2485)
(NASA-TT-F-15166) Avail: NTIS HC $3.00 CSCL 22C

A stinging commentary on past joint European space efforts, with a cry for reorientation of the management approach is presented. Author

N74-10772*# Techtran Corp., Glen Burnie, Md.
MARS SPACECRAFT ON A SUPER LONG JOURNEY
L. Vesnyankin Washington NASA Nov. 1973 6 p Transl. into ENGLISH of the publ. "Marsy' na Sverkhdal'nem Marshe" USSR, Gudok, 18 Sep. 1973 p 4
(Contract NASw-2485)
(NASA-TT-F-15162) Avail: NTIS HC $3.00 CSCL 22A

A popularly written sketch of the various Mars probes of different countries is presented. Author

N74-10773# National Center for Atmospheric Research, Boulder, Colo. High Altitude Observatory.
LIMB DARKENING AND ROTATION BROADENING OF NEUTRAL HELIUM AND IONIZED MAGNESIUM LINE PROFILES IN EARLY-TYPE STARS
T. R. Stoeckley and Dimitri Mihalas Jun. 1973 188 p refs
(Grant NSF GP-23725)
(NCAR-TN/STR-84) Avail: NTIS HC $11.50

Intensity profiles are tabulated as a function of the cosine of the limb darkening angle for neutral helium and ionized magnesium line profiles in early type stars. The calculations are based on non-LTE models and were performed with a turbulent velocity of zero, a helium-hydrogen number ratio of 0.10, and a magnesium-hydrogen number of .0003. Effective temperatures from 15,000 K to 27,500 K were investigated. Flux profiles are presented and the continuum intensity and equivalent widths are given for the flux profile and the intensity profiles at various limb-darkening angles. Rotationally broadened line profiles are tabulated, taking into account the variation of the intensity profile from center to limb. The calculations assume a spherically symmetrical, non-gravity-darkened star in solid body rotation. Author

N74-10774*# Pan Science Systems, Los Angeles, Calif.
THE IMPROVEMENT OF EFFICIENCY IN THE NUMERICAL COMPUTATION OF ORBIT TRAJECTORIES
J. Dyer, R. Danchick, S. Pierce, and R. Haney [1972] 232 p refs
(Contract NAS5-11940)
(NASA-CR-132825; TR-2010) Avail: NTIS HC $13.75 CSCL 22A

An analysis, system design, programming, and evaluation of results are described for numerical computation of orbit trajectories. Evaluation of generalized methods, interaction of different formulations for satellite motion, transformation of equations of motion and integrator loads, and development of efficient integrators are also considered. J.A.M.

N74-10775*# Scripta Technica, Inc., Washington, D.C.
THE METEOROLOGICAL EFFECTS OF COSMIC RAYS
L. I. Dorman NASA Sep. 1973 261 p refs Transl. into ENGLISH of the book "Meteorologicheskiye Effekty Kosmicheskikh Luchey" Moscow, Nauka, 1972 211 p
(Contract NASw-2036)
(NASA-TT-F-755) Avail: NTIS HC $6.25 CSCL 03B

The meteorological effects of mu-meson, electron-photon, neutron, and other components of cosmic rays are reviewed. The theory of the meteorological effect is set forth with substantial improvements made in recent years with consideration of data on meson-nuclear cascades in the earth's atmosphere. The results of numerous experimental investigations made in the U.S.S.R., the U.S.A., Canada, Japan, Great Britain, Australia, Hungary, and other countries are presented. A method of determining the meteorological parameters of the atmosphere's upper layers from cosmic-ray data is described, and data on the inverse effects of cosmic rays on the atmosphere are reported. Author

N74-10776*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DISTANT BOW SHOCK OBSERVATIONS BY EXPLORER 33
J. D. Mihalov Sep. 1973 15 p refs
(NASA-TM-X-62313) Avail: NTIS HC $3.00 CSCL 03B

Locations, orientations and magnetic field changes are given for 135 bow shock crossings at distances downstream from earth between 84 and 117 earth radii. The shock locations are dependent on the spacecraft trajectory and agree with locations calculated for the hypersonic analogue for a Mach number of 3.8. The shock normal vectors have been calculated using magnetic coplanarity. The average normal vectors have a greater inclination by approximately 17 + or - 5 deg from the symmetry axis than the Dryer and Heckman shock orientations for a 3.8 Mach number. Over a range of downstream distances from 60 to 115 earth radii, the median magnetic field magnitude jump across the shock changes from 1.90 to 1.70 times. Author

N74-10777*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A PRELIMINARY DESIGN AND IMPLEMENTATION OF THE LOW-THRUST SIMULATION AND TRAJECTORY SEARCH PROGRAM (LOWTRAJ)
Chen-wan L. Yen 15 Oct. 1973 42 p refs
(Contract NAS7-100)
(NASA-CR-135945; JPL-TM-33-648) Avail: NTIS HC $4.25 CSCL 22A

The results are presented of one phase of research conducted for the JPL Solar Electric Propulsion (SEP) Navigation Software System development program. It deals only with the problem of designing the flight quality trajectory program, which is a major subset of the entire navigation software system. In this phase of research (breadboard development phase), attempts were made to assess the SEP trajectory software functional requirements, to investigate the program design method satisfying these requirements, to identify the primary anticipated problem areas, and to provide solutions to these problem areas. These efforts culminated in the development of a compact breadboard program. A functional description and the mathematical formulation of the program are presented. Author

N74-10778*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS MERCURY, 1973
James H. Wilson 15 Oct. 1973 33 p
(Contract NAS7-100)
(NASA-CR-135942; JPL-TM-33-657) Avail: NTIS HC $3.75 CSCL 22A

The Mariner Venus Mercury 1973 unmanned mission is discussed, which is designed to conduct a close flyby investigation of the planet Mercury after using the gravity-turn technique in a Venus flyby. Its scientific purposes include photographic, thermal, and spectral surveys, radio occulation, and charged particle/magnetic measurements at each planet, observation of solar-system fields and particles from 1.0 a.u. down to 0.4 a.u., and comparative planetary surveys between the Earth, the Moon, Venus, and Mercury. It is also intended to observe Kohoutek's comet. The trajectory permits establishment of a solar orbit in phase with Mercury's, permitting repeated encounters with that planet. Author

N74-10779*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY FLIGHT TRAJECTORIES FOR THE APOLLO SOYUZ TEST PROJECT
Joe D. Brooks Apr. 1973 164 p refs
(NASA-TM-X-64737) Avail: NTIS HC $10.25 CSCL 22A

Preliminary data are documented for a typical launch window opening, a typical in-plane case, and a typical launch window closing trajectory, not necessarily in the same daily launch window, for the Apollo Soyuz test project mission. The Soyuz will be launched first and the Apollo will be launched on the first opportunity, 7 hours 21 minutes later. If the Apollo is unable to be launched on the first opportunity, four additional opportunities are available at 30 hours 56 minutes, 54 hours 31 minutes, 78 hours 05 minutes, and 101 hours 40 minutes. If the Apollo cannot be launched in this time frame, no further attempt will be made to launch and rendezvous with the first Soyuz. Soyuz will then be deorbited; however, a second Soyuz was made available for the same purposes. Author

N74-10780*# Texas Univ., Austin. Applied Mechanics Research Lab.
LOW-THRUST SOLAR ELECTRIC PROPULSION NAVIGATION SIMULATION PROGRAM Final Report
H. Jr. Hagar and T. J. Eller Aug. 1973 64 p Prepared for JPL
(Contracts NAS7-100; JPL-953147)

(NASA-CR-135978; AMRL-1056) Avail: NTIS HC $5.25 CSCL 22A

An interplanetary low-thrust, solar electric propulsion mission simulation program suitable for navigation studies is presented. The mathematical models for trajectory simulation, error compensation, and tracking motion are described. The languages, input-output procedures, and subroutines are included. F.O.S.

N74-10781*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PRELIMINARY DATA ON BOULDERS AT STATION 6, APOLLO 17 LANDING SITE

Grant H. Heiken, Patrick Butler, Jr., Charles H. Simonds, William C. Phinney, Jeffrey Warner, Harrison H. Schmitt, Donald D. Bogard, and William G. Pearce Oct. 1973 56 p refs

(NASA-TM-X-58116; JSC-08484) Avail: NTIS HC $5.00 CSCL 03B

A cluster of boulders at Station 6 (Apollo 17 landing site) consists of breccias derived from the North Massif. Three preliminary lithologic units were established, on the basis of photogeologic interpretations; all lithologies identified photogeologically were sampled. Breccia clasts and matrices studied petrographically and chemically fall into two groups by modal mineralogy: (1) low-K Fra Mauro or high basalt composition, consisting of 50-60% modal feldspar, approximately 45% orthopyroxene and 1-7% Fe-Ti oxide; (2) clasts consisting of highland basalt composition, consisting of 70% feldspar, 30% orthopyroxene and olivine and a trace of Fe-Ti oxide. Author

N74-10782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PHOTOCHEMISTRY OF PLANETARY ATMOSPHERES

Louis J. Stief Oct. 1973 11 p refs

(NASA-TM-X-70511; X-691-73-329) Avail: NTIS HC $3.00 CSCL 03B

The atmospheric composition of Mars is presented, and the applicability of laboratory data on CO2 absorption cross sections and quantum yields of dissociation is discussed. A summary and critical evaluation are presented on the various mechanisms proposed for converting the photodissociation products CO and O2 back to CO2. Author

N74-10783*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STUDY OF AIRBORNE SCIENCE EXPERIMENT MANAGEMENT CONCEPTS FOR APPLICATION TO SPACE SHUTTLE. VOLUME 3: APPENDIXES

Donald R. Mulholland, John O. Reller, Jr., Carr B. Neel, and Louis C. Haughney Aug. 1973 83 p refs

(NASA-TM-X-62289) Avail: NTIS HC $6.25 CSCL 22A

Detailed information is presented concerning specific airborne missions in support of the ASSESS program. These missions are the AIDJEX expeditions, meteor shower expeditions, CAT and atmospheric sampling missions, ocean color expeditions, and the Lear Jet missions. For Vol. 2, see N73-31729. F.O.S.

N74-10784*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

JUPITER'S RADIATION BELTS: CAN PIONEER 10 SURVIVE?

W. N. Hess (NOAA, Boulder, Colo.), T. J. Birmingham, and G. D. Mead Nov. 1973 11 p refs Submitted for publication

(NASA-TM-X-70516; X-641-73-347) Avail: NTIS HC $3.00 CSCL 03B

Model calculations of Jupiter's electron and proton radiation belts indicate that the Galilean satellites can reduce particle fluxes in certain regions of the inner magnetosphere by as much as six orders of magnitude. Average fluxes should be reduced by a factor of 100 or more along the Pioneer 10 trajectory through the heart of Jupiter's radiation belts in early December. This may be enough to prevent serious radiation damage to the spacecraft. Author

N74-10785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE ROLE OF ANTIMATTER IN BIG-BANG COSMOLOGY

Floyd W. Stecker Nov. 1973 13 p Submitted for publication

(NASA-TM-X-70512; X-641-73-332) Avail: NTIS HC $3.00 CSCL 03B

Big bang cosmology is discussed with reference to both its strong points and gaps. Characteristics of a spectral component of red shifted gamma-radiation from cosmological matter-antimatter annihilation show a flattening of the gamma-ray spectrum in the vicinity of 1 MeV, an increased gamma-ray flux between 1 and 100 MeV, and a very steep spectrum between 50 and 135 MeV. This data fits well with the theoretical predictions in energy and intensity. T.M.R.

N74-10786*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE REMOTE SENSING OF SATURN'S RINGS. 1: THE MAGNETIC ALINEMENT OF THE RING PARTICLES

Lawrence C. Evans Washington Nov. 1973 29 p refs

(NASA-TN-D-7475; A-5005) Avail: NTIS HC $3.00 CSCL 03B

Because of the potential implications for the optical properties of Saturn's rings, the orientation of nonspherical ring particles at equilibrium is investigated with respect to four stochastic influences: interactions with the interplanetary medium, interactions with the expected magnetic field of Saturn, thermal fluctuations due to the internal temperature of the ring particles; collisions between ring particles. The solution of the homogeneous Fokker-Planck equation for nearly spherical spheroids is presented and investigated in general. Values of the pertinent physical parameters in the vicinity of Saturn are estimated, and the implications for the alignment of the ring particles are investigated. It is concluded that for some alignment mechanisms, small ring particles can be expected to be almost completely aligned. This alignment results in each particle spinning around its shortest body axis with this axis parallel to the magnetic field direction (perpendicular to the ring plane). Author

N74-10787# Royal Aircraft Establishment, Farnborough (England). Space Dept.

NUMERICAL INTEGRATION OF THE DIFFERENTIAL EQUATIONS OF CELESTIAL MECHANICS

R. H. Merson May 1973 90 p refs

(Contract ESOC-377/71-HR)

(ESRO-CR(P)-283) Avail: NTIS HC $6.50

Various ways of formulating equations of motion of celestial bodies are reviewed together with integration procedures. Tests were carried out on near circular, drag free orbits and high eccentric orbits, namely the HEOS orbits. Provided a suitable independent variable is chosen, the best method is to use the Cowen formulation and integrate by the Gauss-Jackson second-sum process. For highly eccentric orbits, the appropriate independent variable is s, where $dt/ds = r\,3/2$. ESRO

N74-10788# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

ON THE POSSIBILITY OF WANDERING PLANETS EXISTENCE

L. M. Mukhin and V. C. Strelnitsky 1973 13 p refs

(PR-131) Avail: NTIS HC $3.00

The possibility of wandering planet formation by protostar matter expulsion and escape from the protostar gravitational field is discussed. Depending on the stellar wind velocity of the radiation pressure, masses of values similar to Earth or Jupiter masses can be ejected. The density of such planets could be as high as 0.1/cu ps for reasonable assumptions on type O and B star density near the sun, their lifetime, and the galaxy age. Bioevolution and formation on the planets is analysed. Planetary temperature is shown to play a dominant role. Jupiter is taken as an example, and a model of the Jovian atmosphere is detailed. Indications are given about the detectability of such planets for which the IR detector threshold is one order of magnitude lower than achieved in present instruments. ESRO

N74-10789# Aerospace Corp., El Segundo, Calif. Information Processing Div.

TRACE TRAJECTORY ANALYSIS AND ORBIT DETERMINATION PROGRAM. VOLUME 7: USAGE GUIDE. PART A: INPUT DATA

W. D. Downs, R. J. Mercer, Robert H. Prislin, A. J. Rusick, and D. C. Walker 15 Dec. 1972 375 p refs Revised

(Contract F04701-72-C-0073)
(AD-766260; TR-0059(9320)-1-Vol-7-Pt-A-Rev; SAMSO-TR-71-141-Vol-7-Pt-a-Rev) Avail: NTIS CSCL 22/3

The TRACE Trajectory Analysis and Orbit Determination Program is a general-purpose orbital analysis program. It was written and continues to be developed specifically to assist Aerospace Corporation personnel in the analysis and design of satellite orbits and tracking systems. Volume 7 is intended to serve as an input usage guide that defines all input required to perform TRACE functions such as trajectory generation, data/observation generation, orbit determination, and statistical analysis. A comprehensive description for each specific input item is given, and input data structures are shown. The Usage Guide is published in two parts, A and B. Author (GRA)

N74-10885. Joint Publications Research Service, Arlington, Va.
TWO OBJECTS SUGGESTED IN SEARCH FOR EXTRATERRESTRIAL POPULATIONS
G. I. Pokrovskiy *In its* Transl. from Priroda, No. 6, 1973 (JPRS-60251) 11 Oct. 1973 p 1-3 refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1973 p 97-98 (For availability see N74-10884 01-34)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N74-10790*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPILATION, DESIGN TESTS: ENERGETIC PARTICLES SATELLITE S-3 INCLUDING DESIGN TESTS FOR S-3A, S-3B AND S-3C
F. N. LeDoux [1973] 183 p
(NASA-TM-X-70489; X-673-63-156) Avail: NTIS HC $11.25 CSCL 22B

A compilation of engineering design tests which were conducted in support of the Energetic Particle Satellite S-3, S-3A, and S-3b programs. The purpose for conducting the tests was to determine the adequacy and reliability of the Energetic Particles Series of satellites designs. The various tests consisted of: (1) moments of inertia, (2) functional reliability, (3) component and structural integrity, (4) initiatiors and explosives tests, and (5) acceptance tests. Author

N74-10791*# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
DOD/NASA SYSTEM IMPACT ANALYSIS (STUDY 2.1). VOLUME 1: EXECUTIVE SUMMARY Final Report
15 Sep. 1973 30 p refs
(Contract NASw-2472)
(NASA-CR-135764; ATR-74(7331)-1-Vol-1) Avail: NTIS HC $3.50 CSCL 22B

Results are reported from a study made to determine engineering and cost analyses regarding the elements of space transportation systems. Specifically, a tug turnaround cost and abort modes and effects analyses were made. Study approach and objectives for both elements are given. E.H.W.

N74-10792*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ATM C AND D PANEL/EREP COOLING SYSTEM CONTAMINATION PROBLEM
James G. Williamson Oct. 1973 43 p refs
(NASA-TM-X-64788) Avail: NTIS HC $4.25 CSCL 22B

This report presents the history of a preflight contamination problem that occurred in the ATM C and D panel/EREP cooling system on the Skylab, the studies that were made to determine the cause of the problem, and corrective actions that were made prior to lift-off. The results of all the observations, analyses and laboratory testing indicated that the contamination came from one or more of the EREP tape recorder coldplates and was caused by some abnormal electrolytic action, either during bench testing or in the spacecraft. Studies indicate that no such electrolytic action is likely to occur under normal operating conditions. Author

N74-10793*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
ACCEPTANCE TEST REPORT (MI-74067-009-00). SVWS ACCESS ARM (SERIAL NUMBER AA-09-03) (DRAWING 75M08129-13)
John T. Hagood 26 Apr. 1973 98 p refs
(NASA-CR-69472; KSC-TR-1248) Avail: NTIS HC $7.00 CSCL 22B

Acceptance tests were conducted at Kennedy Space Center of the Saturn Vehicle Workshop Spacecraft Access Arm and related equipment. The tests were conducted to prove complete system capability to operate satisfactorily under conditions required to support spacecraft operations and activities. The SVWS Access Arm, serial number AA-09-03, is a Command Module Service Arm, S/A 9, which was removed from the mobile launcher and modified to support the SVWS operations. The C/M environmental chamber was removed and a completely new chamber was installed. The retract system was redesigned to remove the automatic/remote control capability and replaced with a local manual control. The SVWS Access Arm System was successfully tested and supported spacecraft processing without major problems. Author

N74-10794*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
DIGITAL FLIGHT CONTROL SOFTWARE DESIGN REQUIREMENTS
6 Jul. 1973 338 p refs Revised
(NASA-TM-X-69404; JSC-07759-Rev-A) Avail: NTIS HC $19.00 CSCL 22B

The objective of the integrated digital flight control system is to provide rotational and translational control of the space shuttle orbiter in all phases of flight: from launch ascent through orbit to entry and touchdown, and during powered horizontal flights. The program provides a versatile control system structure while maintaining uniform communications with other programs, sensors, and control effects by using an executive routine/function subroutine format. The program reads all external variables at a single point, copies them into its dedicated storage, and then calls the required subroutines in the proper sequence. As a result, the flight control program is largely independent of other programs in the GN and C computer complex and is equally insensitive to the characteristics of the processor configuration. The integrated structure of the control system and the DFCS executive routine which embodies that structure are described. The specific estimation and control algorithms used in the various mission phases are shown. Attitude maneuver routines that interface with the DFCS are also described. Author

N74-10795# Weapons Research Establishment, Adelaide (Australia).
PROJECT HI-STAR SOUTH
W. C. J. White 10 Sep. 1973 22 p
(F6181/12/1) Avail: NTIS HC $3.25

The technical feasibility of launching three Aerobee 200 vehicles at night during April and May 1974 at Woomera is considered. As a scientific objective, the launches are designed to record the sources of infrared radiation in the Southern Celestial Sphere. E.H.W.

N74-10796*# Brunswick Corp., Lincoln, Nebr. Technical Products Div.
FABRICATION OF GRAPHITE/EPOXY CASES FOR ORBIT INSERTION MOTORS Final Report
W. W. Schmidt 20 Aug. 1973 40 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953210)
(NASA-CR-135986; BC-9135-FIN) Avail: NTIS HC $4.00 CSCL 21H

The fabrication procedures are described for filament-wound rocket motor cases, approximately 26.25 inches long by 25.50 inches diameter, utilizing graphite fibers. The process utilized prepreg tape which consists of Fortafil 4-R fibers in the E-759 epoxy resin matrix. This fabrication effect demonstrated an ability

to fabricate high quality graphite/epoxy rocket motor cases in the 26.25 inch by 25.50 inch size range. Author

N74-10797*# North American Rockwell Corp., Downey, Calif. Space Div.
INSULATION COMMONALITY ASSESSMENT (PHASE 1), VOLUME 1: SECTION 1.0 THROUGH 6.0
C. J. Schroeder 1 Feb. 1973 423 p
(Contract NAS7-200)
(NASA-CR-124471; SD-72-SA-0157-1) Avail: NTIS HC $23.25 CSCL 22B

The insulation commonality assessment study was performed to consolidate all the data associated with insulation designs. The scope of the study was limited to the designs associated with the S-2 stage, S-2 derivatives, and technology studies. Data were gathered for various insulation designs and organized into a design manual format. The results of phase 1 are also reported. Author

N74-10798*# North American Rockwell Corp., Downey, Calif. Space Div.
INSULATION COMMONALITY ASSESSMENT (PHASE 1). VOLUME 2: SECTION 7.0 THROUGH 16.0
1 Feb. 1973 584 p refs
(Contract NAS7-200)
(NASA-CR-124473; SD-72-SA-0157-2-Vol-2) Avail: NTIS HC $31.25 CSCL 22B

The heat transfer characteristics of various materials used for the thermal insulation of spacecraft are discussed. Techniques for conducting thermal performance analysis, structural performance analysis, and dynamic analysis are described. Processes for producing and finishing the materials are explained. The methods for determining reliability, system safety, materials tests, and design effectiveness are explained. Author

N74-10799*# Allied Research Associates, Inc., Baltimore, Md.
STUDY OF SPACECRAFT DIRECT READOUT METEOROLOGICAL SYSTEMS Final Report
R. Bartlett, William Elam, and R. Hoedemaker Sep. 1973 196 p refs
(Contract NAS5-21643)
(NASA-CR-132850; Rept-9G94F) Avail: NTIS HC$12.00 CSCL 22B

Characteristics are defined of the next generation direct readout meteorological satellite system with particular application to Tiros N. Both space and ground systems are included. The recommended space system is composed of four geosynchronous satellites and two low altitude satellites in sun-synchronous orbit. The goesynchronous satellites transmit to direct readout ground stations via a shared S-band link, relayed FOFAX satellite cloud cover pictures (visible and infrared) and weather charts (WEFAX). Basic sensor data is transmitted to regional Data Utilization Stations via the same S-band link. Basic sensor data consists of 0.5 n.m. sub-point resolution data in the 0.55 - 0.7 micron spectral region, and 4.0 n.m. resolution data in the 10.5 - 12.6 micron spectral region. The two low altitude satellites in sun-synchronous orbit provide data to direct readout ground stations via a 137 MHz link, a 400 Mhz link, and an S-band link. Author

N74-10800*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
LAUNCH VEHICLE TEST AND CHECKOUT PLAN. - VOLUME 2: SATURN 1B LAUNCH VEHICLE SKYLAB R (RESCUE) AND AS-208 FLOW PLAN AND LISTINGS
6 Aug. 1973 187 p refs Revised 3 Vol.
(NASA-TM-X-69468; KSC-GP-1005-Vol-2-Rev-A) Avail: NTIS HC $10.50 CSCL 22D

The launch operations test and checkout plan is a planning document that establishes all launch site checkout activity, including the individual tests and sequence of testing required to fulfill the development center and KSC test and checkout requirements. This volume contains the launch vehicle test and checkout plan encompassing S-1B, S-4B, IU stage, and ground support equipment tests. The plan is based upon AS-208 flow utilizing a manned spacecraft, LUT 1, and launch pad 39B facilities. Author

N74-10801*# Chrysler Corp., New Orleans, La. Space Div.
INVESTIGATION OF CONFIGURATION EFFECTS ON ENTRY HEATING DISTRIBUTIONS AT MACH NO. EQUAL 8.0 (OH41)
H. Gorowitz (Rockwell International, Downey, Calif.), R. White (Grumman Aerospace Corp.), and A. Derrico (Grumman Aerospace Corp.) Sep. 1973 187 p
(Contract NAS9-13247)
(NASA-CR-128784; DMS-DR-2075) Avail: NTIS HC $11.50 CSCL 22B

Aerodynamic heating data were obtained on 0.006 scale models of four Rockwell International SSV double delta wing Orbiters in the Mach 8 variable density tunnel. A model of two previously tested Rockwell International Orbiters which are identified in the Configuration Description of this report were also tested. Orbiter surfaces were thermally mapped from the laminar through turbulent flight regimes during re-entry. Various modifications were made to model lower surfaces to determine the cause of transition in the vicinity of 3.0 million Reynolds number per foot. Re-entry data were acquired for angles of attack from 25 through 35 degrees at nominal Reynolds numbers per foot of 1.0, 2.0, 2.3, 2.5, 3.0, 3.5, 4.5 and 6.0 million utilizing the phase change paint technique. Launch data were acquired on the model upper surfaces for angles of attack of 0 and -5 degrees at nominal Reynolds numbers per foot of 3.0 and 6.0 million. A total of 70 orbiter heating runs and 6 material sample sphere runs were completed. Author

N74-10802*# Santa Clara Univ., Calif.
DECOMPOSITION-AGGREGATION STABILITY ANALYSIS Final Report, Apr. 1972 - Apr. 1973
D. D. Siljak, S. Weissenberger, and S. M. Cuk Washington NASA Nov. 1973 91 p refs
(Contract NAS8-27799)
(NASA-CR-2196) Avail: NTIS HC $3.75 CSCL 12A

This report presents the development and description of the decomposition aggregation approach to stability investigations of high dimension mathematical models of dynamic systems. The high dimension vector differential equation describing a large dynamic system is decomposed into a number of lower dimension vector differential equations which represent interconnected subsystems. Then a method is described by which the stability properties of each subsystem are aggregated into a single vector Liapunov function, representing the aggregate system model, consisting of subsystem Liapunov functions as components. A linear vector differential inequality is then formed in terms of the vector Liapunov function. The matrix of the model, which reflects the stability properties of the subsystems and the nature of their interconnections, is analyzed to conclude over-all system stability characteristics. The technique is applied in detail to investigate the stability characteristics of a dynamic model of a hypothetical spinning Skylab. Author

N74-10803*# Chrysler Corp., New Orleans, La. Space Div.
PRESSURE LOADS AND AERODYNAMIC FORCE INFORMATION FOR THE -89A SPACE SHUTTLE ORBITER CONFIGURATION, VOLUME 2
R. C. Mennell Sep. 1973 612 p Prepared in cooperation with Rockwell Intern. Corp., Los Angeles
(Contract NAS9-13247)
(NASA-CR-128758; DMS-DR-2021-Vol-2) Avail: NTIS HC $32.75 CSCL 22B

Experimental aerodynamic investigations were conducted in a low speed wind tunnel on an 0.0405 scale representation of the 89A light weight Space Shuttle Orbiter to obtain pressure loads data in the presence of the ground for orbiter structural strength analysis. The model and the facility are described, and data reduction is outlined. Tables are included for data set/run number collation, data set/component collation, model component description, and pressure tap locations by series number. Tabulated force and pressure source data are presented. K.M.M.

N74-10804*# Chrysler Corp., New Orleans, La. Data Management Services.
INVESTIGATION OF CONFIGURATION EFFECTS ON ENTRY HEATING DISTRIBUTIONS AT MACH NO. EQUALS 8.0 (OH41A)
H. Gorowitz (Rockwell Intern.), R. White (Grumman Aerospace

Corp.), and A. D'Errico (Grumman Aerospace Corp.) Sep. 1973 68 p
(Contract NAS9-13247)
(NASA-CR-128785; DMS-DR-2076) Avail: NTIS HC $5.50 CSCL 22B

The results are presented of aerodynamic heating investigations conducted on 0.006 scale models of three Rockwell International Space Shuttle Vehicles (SSV) orbiter configurations in the Mach 8 variable density tunnel. It was established that lower surface modifications to one of these configurations (Model SS-H-00326-4) would alleviate premature transition. Re-entry data were acquired on these models at angles of attack from 30 to 40 degrees for nominal Reynolds numbers per foot of 1.0, 3.0, 6.0 and 8.0 million utilizing the phase change paint technique. A total of 17 orbiter heating runs and 3 orbiter oil flow runs were completed. Author

N74-10805*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 1: TDRS SYSTEM SUMMARY, PART 1 Final Report, 25 Jan. - 21 Aug. 1972
29 Sep. 1972 57 p
(Contract NAS5-21704)
(NASA-CR-132845; SCG-20639R) Avail: NTIS HC $5.00 CSCL 22B

A Tracking and Data Relay Satellite System (TDRSS) concept for service of low and medium data rate user spacecraft has been defined. The TDRS system uses two geosynchronous dual spin satellites compatible with Delta 2914 to provide command, tracking, and telemetry service between multiple low earth orbiting users and a centrally located ground station. The low data rate user service capability via each TDRS is as follows: (1) forward link at UHF: voice to one user, commands to 20 users (sequential), range and range rate service, and (2) return link at VHF: voice from one user, data from 20 users (simultaneous), range and range rate return signals. The medium data rate user service via each TDRS is as follows: (1) forward link at S band: voice or command and tracking signals to one user, and (2) return link at S band: voice, data and tracking signals from one user 'order wire' for high priority service requests (implemented with an earth coverage antenna). Author

N74-10806*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 3: TDRSS CONFIGURATION AND DATA SUMMARY, PART 1 Final Report, 25 Jan. - 21 Aug. 1972
29 Sep. 1972 126 p
(Contract NAS5-21704)
(NASA-CR-132846; SCG-20641R) Avail: NTIS HC $8.50 CSCL 22B

A reference handbook of configuration data and design information is presented. It treats the overall system definition, operations and control, and telecommunication service system including link budgets. A brief description of the user transceiver and ground station is presented. A final section includes a summary description of the TDR spacecraft and all the subsystems. The data presented are largely in tabular form for easy reference. Author

N74-10807*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 4: TDRS SYSTEM OPERATION AND CONTROL AND TELECOMMUNICATIONS SERVICE SYSTEM, PART 1 Final Report, 25 Jan. - 21 Aug. 1972
29 Sep. 1972 336 p refs
(Contract NAS5-21704)
(NASA-CR-132847; SCG-20642R) Avail: NTIS HC $19.00 CSCL 22B

Major study areas treated in this volume are: 1) operations and control and 2) the telecommunication service system. The TDRS orbit selection, orbital deployment, ground station visibility, sequence of events from launch to final orbit position, and TDRS control center functions required for stationkeeping, repositioning, attitude control, and antenna pointing are briefly treated as part of the operations and control section. The last topic of this section concerns the operations required for efficiently providing the TDRSS user telecommunication services. The discussion treats functions of the GSFC control and data processing facility, ground station, and TDRS control center. The second major portion of this volume deals with the Telecommunication Service System (TSS) which consists of the ground station, TDRS communication equipment and the user transceiver. A summary of the requirements and objectives for the telecommunication services and a brief summary of the TSS capabilities is followed by communication system analysis, signal design, and equipment design. Finally, descriptions of the three TSS elements are presented. Author

N74-10808*# Hughes Aircraft Co., El Segundo, Calif. Space and Communications Group.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 5: TDRS SPACECRAFT DESIGN, PART 1 Final Report, 25 Jan. - 21 Aug. 1972
29 Sep. 1972 428 p refs
(Contract NAS5-21704)
(NASA-CR-132848; SCG-20643R) Avail: NTIS HC $23.50 CSCL 22B

A dual spin stabilized TDR spacecraft design is presented for low data rate (LDR) and medium data rate (MDR) user spacecraft telecommunication relay service. The relay satellite provides command and data return channels for unmanned users together with duplex voice and data communication channels for manned user spacecraft. TDRS/ground links are in the Ku band. Command links are provided at UHF for LDR users and S band for MDR users. Voice communication channels are provided at UHF/VHF for LDR users and at S band for MDR users. The spacecraft is designed for launch on the Delta 2914 with system deployment planned for 1978. This volume contains a description of the overall TDR spacecraft configuration, a detailed description of the spacecraft subsystems, a reliability analysis, and a product effectiveness plan. Author

N74-10809*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 4: SPACECRAFT AND SUBSYSTEM DESIGN, PART 1 Final Report
T. E. Hill Oct. 1972 190 p
(Contract NAS5-21705)
(NASA-CR-132839; SD-72-SA-0133-4-Vol-4) Avail: NTIS HC $11.50 CSCL 22B

The design and development of the Tracking and Data Relay satellite are discussed. The subjects covered are: (1) spacecraft mechanical and structural design, (2) attitude stabilization and control subsystem, (3) propulsion system, (4) electrical power subsystem, (5) thermal control, and (6) reliability engineering. Author

N74-10810*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 5: USER IMPACT AND GROUND STATION DESIGN, PART 1 Final Report
T. E. Hill Oct. 1972 64 p
(Contract NAS5-21705)
(NASA-CR-132840; SD-72-SA-0133-5-Vol-5) Avail: NTIS HC $5.25 CSCL 22B

The configuration of the user transponder on the Tracking and Data Relay satellite is described. The subjects discussed are: (1) transponder concepts and trades, (2) ground station design, (3) antenna configurations for ground equipment, (4) telemetry facilities, (5) signal categories, and (6) satellite tracking. Author

N74-10811*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 7:

TELECOMMUNICATIONS SYSTEM SUMMARY, PART 1 Final Report
T. E. Hill Oct. 1972 50 p
(Contract NAS5-21705)
(NASA-CR-132841; SD-72-SA-0133-7-Vol-7) Avail: NTIS HC $4.50 CSCL 22B

The baseline Tracking and Data Relay Satellite telecommunication system is described. The configurations of the user spacecraft terminal and the ground based terminal are illustrated. The system service and performance summary is developed to show the link support, modes of operation, and link performance to the low data rate and medium data rate user spacecraft. The link budget calculation is included to show a typical computation for each space-to-space and space-to-ground link with the assumptions used in each calculation. Author

N74-10812*# North American Rockwell Corp., Downey, Calif. Space Div.
TRACKING AND DATA RELAY SATELLITE SYSTEM CONFIGURATION AND TRADEOFF STUDY. VOLUME 8: APPENDIXES, PART 1 Final Report
T. E. Hill Oct. 1973 140 p refs
(Contract NAS5-21705)
(NASA-CR-132842; SD-72-SA-0133-8-Vol-8) Avail: NTIS HC $9.00 CSCL 22B

The appendices to support the data involved in the design and development of the Tracking and Data Relay satellite are presented. The subjects discussed are: (1) spacecraft structural body shapes, (2) antenna configurations, (3) solar configurations, (4) telemetry equipment, and (5) reliability design practices. Author

N74-10813# National Environmental Satellite Service, Washington, D.C.
OPERATIONAL PRODUCTS FROM ITOS SCANNING RADIOMETER DATA
Edward F. Conlan, comp. Oct. 1973 61 p refs
(NOAA-TM-NESS-52) Avail: NTIS HC $5.25

A manual is presented for the potential user of processed data obtained from the ITOS scanning radiometers. The intent has been to convey primary information in the main text so as to provide an overview for the customer whether his mission be oriented toward operations or research. With this in mind, an attempt is made to minimize the use of specialized phraseology. It is to be expected that a potential user may thereby assess the potential value of the information for his mission even though his familiarity with spacecraft operations or automatic data processing may be limited. Specifically, insight may be gained as to earth location accuracy, precision and stability of calibrated data, areal extent, and time wise availability of products. Author

N74-10814*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT: TELEVISION SYSTEM
Paul P. Coan Washington Nov. 1973 31 p
(NASA-TN-D-7476; JSC-S-300) Avail: NTIS HC $3.00 CSCL 09F

The progress of the Apollo television systems from the early definition of requirements through the development and inflight use of color television hardware is presented. Television systems that have been used during the Apollo Program are discussed, beginning with a description of the specifications for each system. The document describes the technical approach taken for the development of each system and discusses the prototype and engineering hardware built to test the system itself and to perform the testing to verify compatibility with the spacecraft systems. Problems that occurred during the design and development phase are described. Finally, the flight hardware, operational characteristics, and performance during several Apollo missions are described, and specific recommendations for the remaining Apollo flights and future space missions are made. Author

N74-10815# European Space Research and Technology Center, Noordwijk (Netherlands).
DESIGN CONSIDERATIONS OF A MULTICHANNEL INFRARED RADIOMETER FOR TEMPERATURE SOUNDING FROM A GEOSTATIONARY SATELLITE
E. L. Heacock and M. L. Reynolds (Marconi Space and Defence Systems, Camberley, Engl.) 1973 14 p refs Presented at the Intern. Symp. on Meteorol. Satellites, Paris, 21-24 May 1973
Avail: NTIS HC $3.00

The results of a design study of an infrared temperature sounder for use on a possible geostationary meteorological satellite are presented. Initial considerations demonstrate a preference for a 3-axis stabilized satellite configuration in order to facilitate the general design aims of enabling determination of the temperature profile of the troposphere and lower stratosphere, corrected for water vapor content, to a r.m.s. error of better than 2 C, over partly clouded as well as clear areas, on a nominally equidistant grid covering plus or minus 40 North/South and East/West about the satellite sub-point. The proposed instrument design has facility for radiance measurements in eleven spectral channels: six in the CO2 band, two in atmospheric window regions, two in atmospheric water vapor absorption regions and one in an ozone absorption band. Author (ESRO)

N74-10816# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
GIMBAL SYSTEM DESIGN STUDY FOR A DOUBLE GIMBALLED MOMENTUM WHEEL. PART 2: HARDWARE DESIGN STUDY Final Report
Oct. 1972 264 p
(Contract ESTEC-1464/71-HP)
(ESRO-CR(P)-270) Avail: NTIS HC $15.25

A design study is presented for a double gimballed momentum wheel covering the hardware study for the gimbal system. Two configurations are discussed: the inner gimbal system with directly coupled rotary actuators (torquers), ball bearings for gimbal suspension, and a double flywheel in a common housing. The outer gimbal system is similar to the first system but with a single flywheel and the wheel only protected by a housing. The design components are discussed to select the rotary torque, pick off system, gimbal axis ball bearings, lubrication system, electrical signal and power leads, and the caging mechanisms. Design conception and technical solutions adopted for critical design components are described. Thermal reliability, failure mode, mass, and stress analyses are performed. Critical and unsolved problems are discussed together with technical problem areas. Final designs for both gimbal systems are presented. ESRO

N74-10817# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN ON SATELLITE 1964-76 A FROM SEPTEMBER 1964 TO OCTOBER 1965
K. S. Russell 9 Mar. 1973 27 p ref
(ROE-STS-145) Avail: NTIS HC $3.50

Timed observations of Explorer 24 satellite, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order. Author (ESRO)

N74-10818# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN ON SATELLITE 1963-30 D FROM SEPTEMBER 1964 TO OCTOBER 1965
K. S. Russell 6 Mar. 1973 58 p ref
(ROE-STS-144) HC $5.00

Timed observations of the Dash 2 satellite, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order. Author (ESRO)

N74-10819# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
KINETHEODOLITE OBSERVATIONS MADE AT EARLYBURN ON SATELLITE 1963-43 A FROM SEPTEMBER 1964 TO OCTOBER 1965
K. S Russell 9 Mar. 1973 23 p ref
(ROE-STS-146) Avail: NTIS HC $3.25

Timed observations of Polyot satellite, made in azimuth and elevation with a cinetheodolite at Earlyburn Outstation, are listed in launch and time order. Author (ESRO)

N74-10820# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOLID PROPELLANT BALLISTIC MISSILES
A. M. Sinyukov, L. I. Volkov, A. I. Lvov, and A. M. Shishkevich 25 Jul. 1973 726 p refs Transl. into ENGLISH of the publ. "Ballisticheskaya Raketa na Tverdom Toplive" USSR, 1972 p 1-511
(AD-766022; FTD-MT-24-281-73) Avail: NTIS CSCL 16/4

In the report, on the basis of the materials published in the open Soviet and foreign presses, the tasks of ballistic design of solid-propellant rockets are formulated. Typical structural diagrams are given for guided ballistic missiles with engines on solid propellant and the methods of calculation of the elements of their trajectories in connection with the tasks of ballistic design. Approximation methods are illuminated and the concept given about the precise methods of ballistic design. GRA

N74-10821# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
FLIGHT EVALUATION OF THE DISTURBANCE COMPENSATION SYSTEM (DISCOS) ABOARD THE TRIAD SATELLITE
A. Eisner and R. S. Yuhasz Jul. 1973 29 p refs
(Contract N00017-72-C-4401)
(AD-766456; APL-TG-1216) Avail: NTIS CSCL 22/2

The Triad satellite contains an experimental control system called DISCOS (Disturbance Compensation System) which is designed to counteract the nongravitational forces operating on the satellite - notably those caused by atmospheric drag and solar radiation. Using information obtained from flight data from the pulse duration and frequency of the DISCOS thrusters, the performance of the system is compared with that expected in a modelled environment. A significant bias force is found acting in the local vertical direction. Author (GRA)

N74-10822# AiResearch Mfg. Co., Phoenix, Ariz.
HARPOON EXPENDABLE TURBOJET MODEL XJ401-GA-400 Final Report, 30 Jun. 1971 - 13 Apr. 1973
Alvin R. Finkelstein 25 Apr. 1973 335 p refs
(Contract N00019-71-C-0358)
(AD-766145; Rept-73-210057) Avail: NTIS CSCL 16/4

The report documents Phase 2 of the development of a turbojet propulsion system for the Harpoon missile and covers the period from 30 June 1971 through 13 April 1973. The objectives of the Phase 2 development program were: Design, fabrication and development of engine suitable for wind tunnel and flight testing; Delivery of above engines to the weapons system contractor; and Technical liaison with the weapons system contractor, including systems test support. GRA

N74-10823# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GROUND SUPPORT EQUIPMENT FOR MISSILES AND ROCKETS
V. G. Malikov, S. F. Komisarik, and A. M. Korotkov 15 Sep. 1972 426 p refs Transl. into ENGLISH of the publ. "Nazemnoye Oborudovaniye Raket" Moscow, Min. Oborony SSSR, 1971 p 1-304
(AD-754330; FTD-MT-24-455-72) Avail: NTIS CSCL 16/1

The report outlines the fundamentals of the structure and general principles of design of standard units, machines, and structures of launching, transport, erecting, and propellant-loading equipment for contemporary ballistic rockets. The book is intended for command and technical personnel of missile units, and may also be useful to officers in the Soviet Army and students at military academies and in specialized departments of institutions of higher learning. Author (GRA)

N74-10824# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A SYSTEM OF SOFTWARE FOR THE TRIAD FLIGHT COMPUTER
R. S. Yuhasz, H. K. Utterback, and M. R. Newcomer May 1973 110 p refs
(Contract N00017-72-C-4401)
(AD-766455; APL-TG-1217) Avail: NTIS CSCL 22/2

The TRIAD satellite provided APL with its first opportunity to fly a general-purpose digital computer. The paper presents the system of software that was written to develop, test, and operate the APL-designed TRIAD computer. After a description of the machine's real-time flight requirements and its physical properties, the major software projects are discussed. These include the formulation of: Programming language, called ARTIC, and an associated assembler; special-purpose diagnostic and utility programs; a real-time simulation of the expected satellite hardware environment; an in-flight operating system, called LDR, capable of coping with various real-time operational demands. Lastly, the actual performance and utility of the computer after launch is summarized. TRIAD exemplifies the value of a small, programmable computer in managing and supporting complex satellite missions. Author (GRA)

N74-10825# Boston Univ., Mass. Engineering Labs.
EXPERIMENTAL STUDY ON STABILITY OF TRUNCATED SOUNDING ROCKET PAYLOADS Interim Report
Varoujan S. Nersesian Jun. 1973 108 p refs
(Contract F19628-71-C-0209; AF Proj. 7659)
(AD-766250; AFCRL-TR-73-0354; SR-1) Avail: NTIS CSCL 19/7

Stability tests on models of sounding rocket payloads have been performed in the Boston University supersonic wind tunnel. Measurements were made on cone-cylinder shaped models capable of almost unlimited freedom of motion, and truncated along the longitudinal surface from 3% up to 40% of the diameter. The models were supported at different center of gravity positions. Tests were conducted at very high angles of attack, between Mach numbers of 2.0 to 3.5, and at Reynolds numbers in the neighborhood of 1,000,000. Author (GRA)

N74-10234* McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
A THERMAL VACUUM TEST OF SKYLAB ORBITAL WORKSHOP REFRIGERATION SUBSYSTEM
F. W. Sun and R. A. Deak *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 7-18 (For availability see N74-10232 01-11)
CSCL 14B

N74-10245* Bendix Corp., Denver, Colo.
DYNAMICS OF THE SKYLAB WASTE TANK SYSTEM
G. Rupprecht *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 155-174 refs (For availability see N74-10232 01-11)
CSCL 22B

N74-10266* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TESTING OF SPACE SHUTTLE THERMAL PROTECTION SYSTEM PANELS UNDER SIMULATED REENTRY THERMO-ACOUSTIC CONDITIONS
Carl E. Rucker and Robert E. Grandle *In its* Space Simulation, 7th 1973 p 507-521 refs (For availability see N74-10232 01-11)
CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N74-10826 Mississippi Univ., University.
STUDIES OF CRACK TIP STRESSES IN BENDING OF PLATES WITH MULTIPLE CRACKS BY COMPLEX EIGENFUNCTION AND INTEGRAL TRANSFORM TECHNIQUES Ph.D. Thesis
Manohar Lal Arora 1972 127 p
Avail: Univ. Microfilms Order No. 73-11421

Solutions of various crack problems in bending of finite rectangular plates are presented. In one group of problems, classical Poisson - Kirchhoff's theory of bending thin plates is assumed to be applicable and method of complex eigenfunction expansions of unknown variables is employed to solve the mixed boundary value problems of various crack configurations and plate edge conditions. Specifically the following problems

have been considered: (1) a single crack parallel to two simply supported edges and the remaining two parallel edges stress free, (2) a single crack parallel to two simply supported edges and the remaining parallel edges clamped, and (3) two parallel cracks parallel to two simply supported edges and the remaining two edges clamped. Dissert. Abstr.

N74-10827 Texas A&M Univ., College Station.
NONLINEAR FORMULATIONS FOR THE STABILITY ANALYSIS OF PLANAR STRUCTURES Ph.D. Thesis
Mike Emil James, Jr. 1972 110 p
Avail: Univ. Microfilms Order No. 73-12265

Methods are presented for analyzing the elastic stability of planar structures with prismatic members whose deformations are primarily due to bending and axial loads, and whose deformations due to shearing forces may be disregarded. These two methods are the traditional finite element nonlinear analysis and an eigenvalue analysis using a Laguerre Solution Method for obtaining buckling loads. The structures may be subjected to buckling displacements due to imperfections, support settlements or primary loadings. Primary loadings may include distributed and/or concentrated loads. Each of the two methods presented has four formulations resulting from four different strain energy expressions. Three of these strain energy expressions are derived using different curvature expressions in the strain displacement relations. Dissert. Abstr.

N74-10828 Ohio State Univ., Columbus.
FINITE ELEMENT ANALYSIS OF FRACTURE PROPAGATION IN TWO-DIMENSIONAL ELASTIC BRITTLE SOLIDS Ph.D. Thesis
Shang-Wu Huang 1972 134 p
Avail: Univ. Microfilms Order No. 73-11503

A finite element procedure using incremental loading was developed to study progressive cracking in elastic brittle solids. As illustration of usage, the method is applied to study progressive cracking in reinforced concrete beams and around openings in rock. Using Griffith theory and McLintock and Walsh's extension to compressive stress fields, a tension crack is assumed to propagate in an unstable manner within a finite element subjected to an uniform stress field. The crack is assumed planar. Infinitesimal flaws are assumed to preexist in all orientation such that a crack can initiate the critical direction defined by the stress field. The model utilizes an orthotropic material characterization to approximate the state of stress in a cracked material element. Since material nonlinearity is induced by the occurrence of cracks, an incremental loading process with stepwise linearization is used to develop the numerical solution scheme. Application of the model in fracture analysis is demonstrated by solving problems of progressive cracking in reinforced concrete beams. The results are in excellent agreement with experimental observation.
Dissert. Abstr.

N74-10829 Lehigh Univ., Bethlehem, Pa.
SHEAR STRENGTH OF LOW-RISE WALLS WITH BOUNDARY ELEMENTS Ph.D. Thesis
Felix Barda 1972 278 p
Avail: Univ. Microfilms Order No. 73-10934

Results of tests on eight specimens representing low-rise shear walls with boundary elements are reported and analyzed. The principal variables considered are amount of flexural reinforcement, ranging from 1.8 to 6.4 percent of the areas of the boundary elements; amount of horizontal wall reinforcement, ranging from 0 to 0.5 percent of the wall area; amount of vertical wall reinforcement, ranging from 0 to 0.5 percent of the wall area; and height-to-horizontal length ratio, ranging from 1/4 to 1. Special attention is given to the effect of load reversals. The test specimens were made of normal weight concrete having a design compressive strength of 3000 psi. Grade 60 reinforcement was used. The horizontal length of the specimens was 75 in. and the thickness was 4 in. At the vertical extremities of the walls, vertical boundary elements 24 in. wide and 4 in. thick were incorporated. Dissert. Abstr.

N74-10830 Washington Univ., St. Louis, Mo.
COMBINED EIGENVALUE SPECTRA IN STRUCTURAL DYNAMICS BY THE USE OF COMPONENT MODAL RECEPTANCES Ph.D. Thesis
Wei-chi Kung 1972 144 p
Avail: Univ. Microfilms Order No. 73-11816

An analytical method is proposed to combine the eigenvalue spectra of component systems for finding the eigenvalues, natural modes, and responses of the complex coupled linear systems. The proposed method applies also to systems with large damping, if a state variable representation is used. The method can be used for continuous as well as discrete systems. Constant changing of coupling locations is considered in a system with both a rotational component system and a nonrotational component system, as, e.g., helicopter rotor blades and the fuselage. The advantage of the method which uses a normal mode representation of the component system receptances is that the low order coupling matrix allows a simple extraction of the total system characteristic equation. Dissert. Abstr.

N74-10831 Ohio State Univ., Columbus.
THE DYNAMIC COMPRESSION AND RELEASE OF MECHANICAL MIXTURES IN THE PRESENCE OF A PHASE CHANGE PhD. Thesis
Alan Keith Hopkins 1972 89 p
Avail: Univ. Microfilms Order No. 73-11502

An experimental investigation of the shock compression and release behavior of simple homogeneous mechanical mixtures of selected solids was conducted to provide a basis for modeling the dynamic behavior of continuous filament reinforced and plate laminate composites at stress levels where hydrostatic behavior is approximated. The binary mixtures investigated all consisted of a polyethylene matrix with the rigid component chosen from the following: 40 w/o, 70 w/o, and 90 w/o copper; 94.5 w/o tantalum and 70 w/o alumina. A 20 mm smooth bore powder gun was used to launch either copper or tantalum flatface projectiles against the theoretically dense mixtures; the hydrostatic pressure ranging from 25 kilobars to 270 kilobars. The rule of mixtures described the shock loading and release up to the stress required for shock melting the polyethylene; streak photographs and flash X-radiographic techniques gave identical measurements of the free surface velocity. Dissert. Abstr.

N74-10832 Lehigh Univ., Bethlehem, Pa.
A THEORY OF SHALLOW SPHERICAL SHELLS WITH APPLICATION TO CRACK PROBLEMS Ph.D. Thesis
Howard Charles Hagendorf 1972 270 p
Avail: Univ. Microfilms Order No. 73-10936

An improved dynamical shear theory of shallow spherical shells is derived by employing only one assumption in the basic system of shell equations. The tenth order system of equations are uncoupled and all five boundary conditions along an edge of the shell can be satisfied. This theory contains the coupled effects of the longitudinal, transverse, and thickness-shear motion so that it is suitable for the (1) propagation of elastic waves and (2) vibration analysis for frequencies of the order of magnitude of the first thickness-shear mode in an infinite plate. An explicit formula which gives a quantitative estimate of the error inherent in this theory of shallow spherical shells resulting from the approximation is given. The method of integral transforms is used to formulate and solve the static, symmetric problem for a spherical shell containing a finite meridional crack subject to a uniform membrane load and a uniform bending moment applied to the crack surface. The stress field in the neighborhood of the crack tip is obtained in closed form and it is seen to preserve the qualitative features characteritics of the three-dimensional stress state near the crack border in a thick plate.
Dissert. Abstr.

N74-10833 California Univ., Los Angeles.
[VISIOPLASTICITY ANALYSIS ON STRESS AND STRAIN DISTRIBUTION DURING SLOW BENDING OF NOTCHED STEEL SPECIMENS] Ph.D. Thesis
Salah Abbas Mohamed 1972 224 p
Avail: Univ. Microfilms Order No. 73-10451

The visioplasticity technique has been carried out to obtain the stress and strain fields for notched bars loaded in planestrain bending. The strain distribution in the vicinity of the notch was determined as a function of bend angle. The solution allows for the actual work-hardening of the material and can be used to measure large (60%) strains at the notch root. Good agreement

was found between the strain distribution obtained by this technique and the available experimental data of microhardness measurements. The maximum normal stress occurs below the notch root at small angles of bend and moves towards the notch root at high angles of bend. The effect of notch depth and notch root were studied and it was found that both sharp and deep notches will result in high strain gradients and triaxial constraint. The results were used to develop macroscopic fracture criteria in terms of microscopic ductility. Dissert. Abstr.

N74-10834 Ohio State Univ., Columbus.
STRESS WAVE PROPAGATION IN A CURVED TRANSMISSION LINE Ph.D. Thesis
Nelson tSaichuang 1972 86 p
Avail: Univ. Microfilms Order No. 73-11533

For the purpose of investigating stress wave propagation of a curved elastic plate, both exact and approximate analyses were explored within the framework of the linear theory of elasticity. In the exact analysis, a frequency equation derived from Navier's equations and approximate boundary conditions were developed. By extensively employing computer analysis, the frequency spectrum of the first few propagating modes was obtained. On the other hand, a less complicated approximate theory for the three selected modes, which are predominantly associated with the transmission of mechanical energy in a curved plate, was developed. The equations take into account coupling between the three modes. A final comparison indicates that a reasonable agreement between the exact and approximate theories is achieved. Dissert. Abstr.

N74-10835*# Aluminum Co. of America, Pittsburgh, Pa.
EVALUATION OF STRESS CORROSION CRACKING SUSCEPTIBILITY USING FRACTURE MECHANICS TECHNIQUES, PART 1 Final Report, 1 Jul. 1968 - 31 Aug. 1972
D. O. Sprowls, M. B. Shumaker, J. D. Walsh, and J. W. Coursen 31 May 1973 303 p refs
(Contract NAS8-21487)
(NASA-CR-124469) Avail: NTIS HC $17.25 CSCL 20K

Stress corrosion cracking (SSC) tests were performed on 13 aluminum alloys, 13 precipitation hardening stainless steels, and two titanium 6Al-4V alloy forgings to compare fracture mechanics techniques with the conventional smooth specimen procedures. Commercially fabricated plate and rolled or forged bars 2 to 2.5-in. thick were tested. Exposures were conducted outdoors in a seacoast atmosphere and in an inland industrial atmosphere to relate the accelerated tests with service type environments. With the fracture mechanics technique tests were made chiefly on bolt loaded fatigue precracked compact tension specimens of the type used for plane-strain fracture toughness tests. Additional tests of the aluminum alloy were performed on ring loaded compact tension specimens and on bolt loaded double cantilever beams. For the smooth specimen procedure 0.125-in. dia. tensile specimens were loaded axially in constant deformation type frames. For both aluminum and steel alloys comparative SCC growth rates obtained from tests of precracked specimens provide an additional useful characterization of the SCC behavior of an alloy. Author

N74-10836*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
GROWTH CHARACTERISTICS OF A PLANE CRACK SUBJECTED TO THREE-DIMENSIONAL LOADING
R. J. Hartranft and G. C. Sih Jul. 1973 36 p refs
(Grant NGR-39-007-066)
(NASA-CR-132343; NASA-TR-73-4; IFSM-73-46) Avail: NTIS HC $4.00 CSCL 20K

The closed form expressions for the stress intensity factors due to concentrated forces applied to the surfaces of a half plane crack in an infinite body are used to generate solutions for distributed loads in this geometry. The stress intensity factors for uniformly distributed loads applied over a rectangular portion of the crack surface are given in closed form. An example of non-uniformly distributed loads which can be treated numerically is also included. In particular, combinations of normal and shear stresses on the crack which simulate the case of loading at an angle to the crack front are considered. The resulting stress intensity factors are combined with the strain energy density fracture criterion for the purpose of predicting the most likely direction of crack propagation. The critical value of the energy density factor can then be used for determining the allowable load on a specimen with a crack front not perpendicular to the tensile axis. Author

N74-10837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BOUNDARY-INTEGRAL METHODS IN ELASTICITY AND PLASTICITY
Alexander Mendelson Washington Nov. 1973 38 p refs
(NASA-TN-D-7418; E-7478) Avail: NTIS HC $3.00 CSCL 20K

Recently developed methods that use boundary-integral equations applied to elastic and elastoplastic boundary value problems are reviewed. Direct, indirect, and semidirect methods using potential functions, stress functions, and displacement functions are described. Examples of the use of these methods for torsion problems, plane problems, and three-dimensional problems are given. It is concluded that the boundary-integral methods represent a powerful tool for the solution of elastic and elastoplastic problems. Author

N74-10838*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CHARACTERISTICS OF CAPACITOR-TYPE MICROMETEOROID FLUX DETECTORS WHEN IMPACTED WITH SIMULATED MICROMETEOROIDS
Philip C. Kassel, Jr. Washington Nov. 1973 38 p refs
(NASA-TN-D-7359; L-8962) Avail: NTIS HC $3.00 CSCL 14B

A series of impact tests are described and data presented which characterize the operation of the capacitor-type micrometeoroid flux detectors used on the Meteoroid Technology Satellite (MTS). Capacitor-type detectors with silicon dioxide dielectric thickness of 0.4 and 1.0 microns were tested in the micrometeoroid impact simulator at the Langley Research Center, a 4-MV Van de Graaff electrostatic accelerator. The carbonyl iron projectiles were from 0.5 to 5.0 microns in diameter with velocities from 4 to 10.0 km/sec. The detector bias voltage was varied from -20 to -60 V; some tests were at detector temperatures of 90 C to -100 C; and the angle of impact varied from 0 deg to 75 deg from the normal to the detector. These tests showed that: (1) the detector operation is reliable when the bias voltage is greater than 30 V; (2) after an impact the detector returns to its original condition with an insignificant loss of active area; and (3) the sensitivity of the detector is inversely proportional to the detector thickness. The test results suggest a theoretical model in which the signal is an arc triggered by the impacting projectile, and the detector bias voltage must be high enough to insure that an arc will form. Author

N74-10839*# Kaman Aerospace Corp., Bloomfield, Conn.
AN EVALUATION OF A CONSTRAINED TEST METHOD FOR OBTAINING FREE BODY RESPONSES
A. Berman, N. Giansante, and F. D. Bartlett, Jr. Washington NASA Oct. 1973 144 p refs
(Contract NAS1-11535)
(NASA-CR-2307; R-1130) Avail: NTIS HC $4.50 CSCL 20K

A method for obtaining free body responses from dynamic tests on a constrained structure is investigated for practical feasibility. The method is based on the principle that a constrained structure can be considered to be a free body acted upon by multiple forces which include the forces of constraint. By measuring these forces and by exciting the structure so as to develop linearly independent sets of forces, the response of the free body to one force at a time can be computed. Techniques for producing these independent forces are discussed. The development of the theory, computer simulations of tests of representative aerospace vehicles (including experimental error), and a description and listing of the computer programs developed are included. The procedure appears to be a practical method for obtaining in-flight characteristics of such vehicles. Author

N74-10840*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAM FOR STRUCTURAL ANALYSIS OF LAYERED ORTHOTROPIC RING-STIFFENED SHELLS OF REVOLUTION (SALORS), LINEAR STRESS ANALYSIS

OPTION
Walter L. Heard, Jr., Melvin S. Anderson, and Ming M. Chen Washington Oct. 1973 162 p refs
(NASA-TN-D-7179; L-6773) Avail: NTIS HC 4.75 CSCL 20K

A general computer program written in FORTRAN 4 symbolic language is presented for the linear static analysis of asymmetrically loaded, thin, elastic shells of revolution. The program is equipped to handle segmented, laminar, orthotropic shells with discrete rings. Provisions are made for handling meridional variations in material properties, temperatures, and wall thickness. The program also allows linear variations of temperature, through each layer of the shell wall. Meridional discontinuities in geometry, temperature and material properties and the actual load path through the joint at a discontinuity are accounted for. The effects of longitudinal stiffening (stringer) are automatically distributed circumferentially. Circumferential variations of loads and temperatures are handled by Fourier series expansion. A theoretical development, a complete user's manual, and four example problems are presented. Author

N74-10841*# National Aeronautics and Space Administration, Washington, D.C.
COMPUTER PROGRAMS: MECHANICAL AND STRUCTURAL DESIGN CRITERIA: A COMPILATION Technology Utilization.
[1973] 17 p
(NASA-SP-5966(01)) Avail: NTIS HC $2.75 CSCL 20K

Computerized design criteria for turbomachinery and the constraints imposed by very high rotational fields are presented along with a variety of computerized design criteria of interest to structural designers. Author

N74-10842*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VIBRATION BEHAVIOR OF FUEL-ELEMENT VIBRATION SUPPRESSORS FOR THE ADVANCED POWER REACTOR
Donald W. Adams and Ivan B. Fiero Washington Nov. 1973 31 p refs
(NASA-TM-X-2920; E-6816) Avail: NTIS HC $3.00 CSCL 18I

Preliminary shock and vibration tests were performed on vibration suppressors for the advanced power reactor for space application. These suppressors position the fuel pellets in a pin type fuel element. The test determined the effect of varying axial clearance on the behavior of the suppressors when subjected to shock and vibratory loading. The full-size suppressor was tested in a mockup model of fuel and clad which required scaling of test conditions. The test data were correlated with theoretical predictions for suppressor failure. Good agreement was obtained. The maximum difference with damping neglected was about 30 percent. Neglecting damping would result in a conservative design. Author

N74-10843# National Aerospace Lab., Tokyo (Japan).
NATURAL VIBRATION AND PANEL FLUTTER OF CYLINDRICALLY CURVED PANELS
Yuji Matsuzaki Apr. 1973 13 p refs
(NAL-TR-315T) Avail: NTIS HC $3.00

Influences of in-plane boundary conditions and panel geometry on natural vibration and flutter characteristics of cylindrically curved panels, exposed to a supersonic flow parallel to the generators, are analyzed with the aid of Galerkin's method within the framework of Reissner's shallow shell theory. Almost all results are obtained by using twelve assumed modes, namely, a combination of the first six streamwise and the first two symmetrical spanwise modes. Convergence of flutter solutions is checked by taking the first ten streamwise modes. The numerical results have revealed that influences of in-plane boundary conditions and panel geometry are much more complicated than previously reported. Since some results indicate that spanwise model coupling due to the in-plane edge restraint yields coincidence of natural frequencies which has a detrimental effect on flutter boundary, omission of the higher spanwise modes in flutter analysis leads to erroneous results for such cases. Author

N74-10844# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
THE DESIGN OF SELF-SUPPORTING STEEL CHIMNEYS
D. J. Johns and R. Nataraja Feb. 1973 68 p refs Supersedes TT-6915
(TT-7301; TT-6915) Avail: NTIS HC $5.50

The criteria for allowable stress and deflection and for prevention of sway and ovalling modes of vibration due to wind were laid down in a simple manner. The charts will enable the designer to select the geometrical parameters which will satisfy the various criteria. Ring stiffeners should be used if necessary to avoid ovalling instability. The sway mode of instability criterion determines the allowable value of length/radius ratio for many values of diameter/thickness ratios. Of the two static criteria, the allowable deflection criterion seems to be more critical than the allowable stress criterion for the geometries encountered in practice. The design boundaries based on the various limiting values in the analyses are established. Author

N74-10845# Institut Franco-Allemand de Recherches, St. Louis (France).
FUNDAMENTAL PRINCIPLES OF FLAW MECHANICS [PRINCIPES FONDAMENTAUX DE LA MECANIQUE DES RUPTURES]
A. Lichtenberger 21 Apr. 1972 35 p refs In FRENCH
(ISL-NB-2/72) Avail: NTIS HC $3.75

The present state of fracture mechanics is set forth. Various procedures to determine the principal characteristics parameters are described. They include optical recording, measurements using extensometric sensors, electrical potential measuring methods, and acoustic measurements. Emphasis is laid on the constraint intensity factor. Finally the difficulties encountered when applying fracture mechanics to plastic deformation materials and to composite materials, as well as crack detection and simulation, are presented. ESRO

N74-10846# Institut Franco-Allemand de Recherches, St. Louis (France).
DAMAGE THRESHOLD DETERMINATION OF LIGHT WALLS SUBMITTED TO SINGLE OR REPEATED BANGS, PART 1 [DETERMINATION DU SEUIL D'ENDOMMAGEMENT DE CLOISONS LEGERES EXPOSEES A DES BANGS UNITAIRES OU REPETES. PREMIERE PARTIE]
J. P. Thybaut, B. Antoine, and Ch. Johe 20 Dec. 1972 54 p refs In FRENCH
(Contract DRME-72/184)
(ISL-35/72-Pt-1) Avail: NTIS HC $4.75

The behavior and fatigue of light walls submitted to sonic bangs were investigated using N-shock waves produced by a shock generator and impacting a plastered brick wall. Wall measuring instruments included extensometric gages, displacement sensors, and accelerometers. Results on degradation thresholds showed that 7 to 8 m bar bangs provoke horizontal tracks. Vertical cracks were induced by 13 to 14 m bar bangs, while diagonal cracks were generated by 16 m bar bangs. Complete wall rupture occurred when higher than 20 m bar bangs were used. Fatigue tests revealed that walls, when submitted to 12 m bar bang intensity, can be subjected to a hundred of bangs without any damage. ESRO

N74-10847# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELASTIC CHARACTERISTICS OF MULTILAYER STRUCTURES WITH HONEYCOMB FILLER
A. E. Zhuravel 10 Aug. 1973 11 p refs Transl. into ENGLISH from Tepl. Napryazh. v Elementakh Konstruktsii (USSR), no. 1970 p 301-307
(AD-766043; FTD-HT-23-760-73) Avail: NTIS CSCL 13/13

The report describes the plastic properties of a dynamic/static loaded honeycomb core sandwich structure. GRA

N74-10848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CYCLICALLY SYMMETRICAL DEFORMATION OF A MULTILAYER ORTHOTROPIC CONICAL SHELL UNDER THE EFFECTS OF FORCE AND TEMPERATURE
V. G. Karnaukhov and A. E. Zhuravel 10 Aug. 1973 15 p refs Transl. into ENGLISH from Tepl. Napryazh. v Elementakh Konstruksii (USSR), no. 8, 1969 p 34-43
(AD-765988; FTD-HT-23-761-73) Avail: NTIS CSCL 20/11

The authors examine a multilayer conical shell subjected to the effect of nonuniform heating and external forces. The shell consists of an arbitrary number of orthotropic layers whose thermal and mechanical properties and temperature vary through the thickness according to any law. GRA

N74-10849# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BUILD-UP OF RESIDUAL STRAIN UNDER THE ACTION OF LIVE LOADS WITH TIMES
M. I. Rozovskii and O. I. Shakalova 13 Apr. 1973 9 p refs Transl. into ENGLISH of the publ. "Problemy Nadezhnosti v Stroitelnoi Mekhanike" Dneprooetrovsk, Jun. 1968 p 70-73
(AD-759677; FTD-HT-23-225-73) Avail: NTIS CSCL 20/11

The problem dealing with the buildup of residual strain is examined in a material possesing heriditary properties under the action of live loads with time. Author

N74-10850# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR AND LINEAR TRANSIENT DEFORMATION WAVES IN THERMOELASTIC AND ELASTIC BODIES
U. K. Nigul and J. K. Engelbrecht 15 Aug. 1973 142 p refs Transl. into ENGLISH of the publ. "Nelineinye i Lineinye Perekhodnyi e Volnovye Protsessy Deformatsii Thermouprugikh i Uprugikh Tel" USSR, 1972 p 1-170
(AD-766033; FTD-MT-24-27-73) Avail: NTIS CSCL 20/11

Axiomatic thermomechanics of a continuum and the introduction of supplementary postulates are used to construct a nonlinear theory of thermoelasticity, one postulate of which is a nonlinear equation of thermal conductivity of comparatively general form. From this equation of thermal conductivity and as a result of appropriate simplifications, certain versions of the linear and nonlinear equations of thermal conductivity are derived. Based on this nonlinear theory of thermoelasticity concrete mathematical models are constructed (closed systems of equations), which assume the first derivative of displacements in Lagrange coordinates and the relative temperature change to be small (in comparison with unity). The theory of elasticity is considered as a particular case of the theory of thermoelasticity. It is shown that in the case of typical structural materials the geometric and physical nonlinearity cause nonlinear effects of identical order. GRA

N74-10851#, Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
STRESSES IN CIRCULAR CYLINDRICAL SHELLS OF COMPOSITE MATERIALS SUBJECTED TO LOCALIZED LOADS
Howard S. Kliger, George Z. Forristall, and Jack R. Vinson Oct. 1973 82 p refs
(Contract AF-AFOSR-1760-69)
(AD-757536; MAE-TR-161; AFOSR-73-0494TR) Avail: NTIS CSCL 13/13

Methods of analysis are developed to provide the stresses (both bending and membrane) and deformations in specially orthoropic circular cylindrical shells subjected to localized loads. An accurate shell theory is employed which includes the effects of orthotropy and transverse shear deformation. The governing differential equations are obtained, and are transformed into a set of algebraic equations through expanding all displacements, rotation, and the localized loading in a doubly infinite series in the shell coordinates. A computer program is formulated, and included, to perform numerical calculations easily using the analytic solutions. (Modified author abstract) GRA

N74-10852# North Carolina State Univ., Raleigh. Dept. of Mathematics.
FRACTURE MECHANICS, ELASTICITY AND THEIR APPLICATIONS Final Report, 1 Jul. 1969 - 31 Dec. 1972
W. J. Harrington 1 Mar. 1973 13 p refs
(Grant AF-AFOSR-1779-69; AF Proj. 9749)
(AD-758793; AFOSR-73-0554TR) Avail: NTIS CSCL 20/11

The report is a summary of project research, personnel and publications under Grant AFOSR 69-1779, July 1, 1969 through December 31, 1972. Author (GRA)

N74-10853# Army Foreign Science and Technology Center, Charlottesville, Va.
INFLUENCE OF RELATIVE THICKNESS ON LIMITING DEFORMATION DURING BULGING OF A MEMBRANE UNDER HYDROSTATIC PRESSURE
A. D. Matveev 12 Mar. 1973 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (Moscow), no. 6, 1970 p 15-19
(AD-759581; FSTC-HT-23-1637-72) Avail: NTIS CSCL 13/9

The article considers the effect of relative thickness on the limiting deformation of membranes. The deformation of membranes which are rigidly attached along a circular contour is studied experimentally. The materials studied are low carbon steel with a thickness of 0.5 mm and soft aluminum with a thickness of 1.4 mm. A change in the membrane radius from 205 to 13.5 mm yields a considerable change in the deformation magnitudes in the membrane pole at the breakdown instant and is reflected in the form of the finite sector of the relationship between the pressure of the fluid and the membrane depth. Author (GRA)

N74-10854# ARA, Inc., West Covina, Calif.
RESEARCH ON ENERGY ABSORBING STRUCTURES, PART 11 Annual Report, 1 Feb. 1972 - 1 Feb. 1973
Bernard Mazelsky, Tung Hua Lin, Sheng-Rong Lin, and Shih-Chang Liu Mar. 1973 61 p refs
(Contract F44620-71-C-0043; AF Proj. 9782)
(AD-760161; ARPA-154; AFOSR-73-0775TR) Avail: NTIS CSCL 13/3

A numerical method for analyzing large deflections of shells of revolution under axisymmetric loading with arbitrary creep characteristics is given. Creep strain is treated as an equivalent external loading. Two nonlinear differential equations similar to Reissner's equations are presented and solved by the iterative scheme and the finite difference approximation. The multiaxial stress-strain-time relationship is formulated from the empirical uniaxial curve based on the second deviated stress and strain invariants. Examples are given for a corrugated tube subject to an axial load at an elevated temperature. The results show the nonlinear effects due to finite strain and creep strain. The method shown may also be applied to axisymmetric shells subject to thermal and plastic strains. (Author modified abstract) GRA

N74-10855# Waterloo Univ. (Ontario). Dept. of Civil Engineering.
APPLICATION OF CRITICAL: LOCATION APPROACH OF FATIGUE ANALYSIS IN STRUCTURAL DESIGN
C. V. B. Gowda and T. H. Topper 1973 26 p refs
(Grant AF-AFOSR-2120-71; AF Proj. 9782)
(AD-760160; AFOSR-73-0774TR) Avail: NTIS CSCL 20/11

Structural fatigue failures usually originate in a small localized region adjacent to stress raisers which typically experience inelastic deformation under service loads. Therefore, fatigue analyses consist of: evaluation of material response to complex inelastic straining sequences; inelastic deformation analysis of local regions near stress raisers; cumulative damage procedures which take inelastic deformation and complexities in service loads into account. These three aspects are discussed for simple loading sequences and a computer-based model which combines all three aspects of analyses for complex load histories is reviewed. Accuracy of the analyses for different loading conditions is checked by using results from recent studies. Finally, this paper attempts to communicate to designers the implications of recent developments in the fatigue analyses of notched and unnotched structural components subjected to service loads. Author (GRA)

N74-10856# Picatinny Arsenal, Dover, N.J.
GRAPHIC AXISMMETRIC SHELL PROGRAM (GRASP)
Wayne D. Lunger Jun. 1973 84 p refs
(AD-766229; PA-TM-2104) Avail: NTIS CSCL 20/11

GRASP represents the implementation of interactive graphic techniques to the SHELL MOMENT program. The SHELL MOMENT program, developed a decade ago, applies thin wall theory plus a discontinuity type of stress analysis to symmetrically loaded shells of revolution. The analysis produces the local bending moments and shears, displacements, and stresses at discontinuities in the shell (discontinuity of loading, contour, and/or material). Redesign of the shell may be accomplished at the CRT console. Technical Report 3762 describes the batch

(pre-graphics) program. GRASP was written for a CDC 6500/1700/274 facility operating under SCOPE 3.3, IGS V.2 employing 9 overlays and 45 K words of storage.
Author (GRA)

N74-10439 Institut Franco-Allemand de Recherches, St. Louis (France).
SOME TERMINAL BALLISTICS PROBLEMS [EINIGE ENDBALLISTISCHE PROBLEMS]
G. Weihrauch *In its* Papers on Ballistics and Phys. of Transience 1973 p 48-76 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N74-10857 Michigan Univ., Ann Arbor.
RELATIONSHIP OF CYCLIC COMBUSTION VARIATIONS AND MIXTURE MOTION IN A SPARK-IGNITION ENGINE Ph.D. Thesis
Richard Edward Winsor 1972 112 p
Avail: Univ. Microfilms Order No. 73-11301

Cyclic combustion variations were studied in a single cylinder CFR engine with a pancake combustion chamber. Variations in the combustion duration were shown to be related to mixture velocity and its variations through a simple model. This model postulates a critical flame radius increment in which mixture motion variations near the spark electrodes create the cyclic combustion variations. From experimental measurements, the critical flame radius increment in this engine was found to be about 0.4 in. The mixture motion measurements were made with a hot-wire anemometer in the engine motored without fuel. A new calibration and calculation technique was developed in order to obtain velocities from the anemometer output in the varying temperature and pressure environment of the engine. Tests were run at full and part load over the speed range of 500 - 1500 rpm. It was found that near TDC the turbulence in the engine was isotropic and the turbulent velocity increased linearly with engine speed. Dissert. Abstr.

N74-10858 National Lending Library for Science and Technology, Boston Spa (England).
THE CONSTRUCTION OF A MATHEMATICAL MODEL OF THE PROCESS OF COMBUSTION OF TiCl4 IN A CURRENT OF OXYGEN
V. A. Ivanov et al Jul. 1973 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (USSR), no. 5, 1972 p 152-156
(NLL-RTS-8250) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.90; 3 NLL photocopy coupons

The mathematical model of the combustion process is expanded to include the relationship of the number of particles of TiO2, and dispersion. The side reactions of chloride production of pigmentary TiO2 are considered, and the expression for the number of particles is developed along with the dispersion equation. F.O.S.

N74-10859*# Naval Postgraduate School, Monterey, Calif.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF ROTATING, NONCAPILLARY HEAT PIPES
Paul J. Marto Washington NASA Sep. 1973 59 p refs
(NASA Order W-13007)
(NASA-CR-130373; NPS-59MX72111A) Avail: NTIS HC $5.00 CSCL 20M

An approximate theoretical model is derived for laminar film condensation on the inside of a rotating, truncated cone, and is used to predict the heat transfer performance of rotating, noncapillary heat pipes for a wide variety of parametric conditions. Experimental results are presented for water, ethyl alcohol, and freon-113 in a stainless steel heat pipe rotating to speeds of 2800 RPM. Results show that these devices can be used effectively to transfer large quantities of heat in rotating systems. Predicted results agree to within plus or minus 20 percent to the experimental data. Dropwise condensation, instead of film condensation, improves heat pipe performance while the presence of noncondensible gases impairs performance. Author

N74-10860*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE CONTROL OF CARBON DIOXIDE CRYODEPOSITS
Ellsworth L. Sharpe Washington Nov. 1973 32 p refs
(NASA-TN-D-7334; L-8884) Avail: NTIS HC $3.00 CSCL 20M

An experimental study has been conducted to investigate the parameters affecting the cryodeposition of carbon dioxide frost. In the investigation carbon dioxide frost was cryodeposited from a helium-carbon dioxide mixture into a layer of fibrous insulation surrounding a cylindrical cryogenic tank. Results of the study indicated that not only did deposition occur on the frost surface but also within the frost layer. Over the range of variables investigated both the frost density and the mass of frost deposited were most sensitive to the time of deposition, the percent of carbon dioxide in the purge-gas mixture, and the thickness of the insulation. Frost density and mass of frost deposition were found to increase with time and percent carbon dioxide, and to decrease with increasing insulation thickness. Author

N74-10861*# Georgia Inst. of Tech., Atlanta.
THE PREDICTION OF NONLINEAR THREE DIMENSIONAL COMBUSTION INSTABILITY IN LIQUID ROCKETS WITH CONVENTIONAL NOZZLES
Eugene A. Powell and Ben T. Zinn Oct. 1973 174 p refs
(Grant NGL-11-002-083)
(NASA-CR-121279) Avail: NTIS HC $10.75 CSCL 21B

An analytical technique is developed to solve nonlinear three-dimensional, transverse and axial combustion instability problems associated with liquid-propellant rocket motors. The Method of Weighted Residuals is used to determine the nonlinear stability characteristics of a cylindrical combustor with uniform injection of propellants at one end and a conventional DeLaval nozzle at the other end. Crocco's pressure sensitive time-lag model is used to describe the unsteady combustion process. The developed model predicts the transient behavior and nonlinear wave shapes as well as limit-cycle amplitudes and frequencies typical of unstable motor operation. The limit-cycle amplitude increases with increasing sensitivity of the combustion process to pressure oscillations. For transverse instabilities, calculated pressure waveforms exhibit sharp peaks and shallow minima, and the frequency of oscillation is within a few percent of the pure acoustic mode frequency. For axial instabilities, the theory predicts a steep-fronted wave moving back and forth along the combustor. Author

N74-10862# RAND Corp., Santa Monica, Calif.
PHYSICAL MODELS OF FIRES AND THEIR ASSOCIATED ENVIRONMENT
Andrew M. Stein (Pacific Southwest Forest and Range Experiment Station, Riverside, Calif.), John G. Sullivan (Calif. Univ., Riverside), and Francis W. Murray Jul. 1973 25 p refs Submitted for presentation at AIAA 12th Aerospace Sci. Meeting, Fluid Dyn. Session, 30 Jan. - 1 Feb. 1974
(P-5049) Avail: NTIS HC $3.25 CSCL 21B

The feasibility of using analytical models of fires and their associated environment to: (1) predict and study flow dynamics surrounding a source disturbance, and (2) analyze production and distribution of pollutants resulting from combustion and photochemical processes is discussed. Data also cover the use of the models for long range planning, forecasting, and environment management. E.H.W.

N74-10863*# Aeronautical Research Associates of Princeton, Inc., N.J.
SOME ANALYSES OF THE CHEMISTRY AND DIFFUSION OF SST EXHAUST MATERIALS DURING PHASE 3 OF THE WAKE PERIOD
Glenn R. Hilst, Coleman DuP. Donaldson, and Ross Contiliano Jul. 1973 88 p refs

(Contract NAS1-11873)
(NASA-CR-132323; ARAP-199) Avail: NTIS HC $6.50 CSCL 21B

In the generally stably stratified lower stratosphere, SST exhaust plumes could spend a significant length of time in a relatively undispersed state. This effort has utilized invariant modeling techniques to simulate the separate and combined effects of atmospheric turbulence, turbulent diffusion, and chemical reactions of SST exhaust materials in the lower stratosphere. The primary results to date are: (1) The combination of relatively slow diffusive mixing and rapid chemical reactions during the Phase III wake period minimizes the effect of SST exhausts on O3 depletion by the so-called NOx catalytic cycle. While the SST-produced NO is substantially above background concentrations, it appears diffusive mixing of NO and O3 is simply too slow to produce the O3 depletions originally proposed. (2) The time required to dilute the SST exhaust plume may be a significant fraction of the total time these materials are resident in the lower stratosphere. If this is the case, then prior estimates of the environmental impact of these materials must be revised significantly downward. Author

N74-10864*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHOCK-TUBE THERMOCHEMISTRY TABLES FOR HIGH-TEMPERATURE GASES. VOLUME 5: CARBON DIOXIDE
W. A. Menard and T. E. Horton 15 Mar. 1971 67 p refs
(Contract NAS7-100)
(NASA-CR-135944; JPL-TR-32-1408-Vol-5) Avail: NTIS HC $5.50 CSCL 20M

Equilibrium thermodynamic properties and species concentrations for carbon dioxide are tabulated for moving, standing, and reflected shock waves. Initial pressures range from 6.665 to 6665 N/sq m (0.05 to 50.0 torr), and temperatures from 2,000 to over 80,000K. In this study, 20 molecular and atomic species were considered. Author

N74-10865# Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
A COMPUTER PROGRAMME FOR THE CALCULATION OF EQUILIBRIUM COMPOSITION AND ADIABATIC FLAME TEMPERATURES OF GASEOUS MIXTURES UNDERGOING CONSTANT PRESSURE COMBUSTION
A. M. Garforth Aug. 1973 76 p refs
(Rept-56; ISBN-0-85494-210-6) Avail: NTIS HC $6.00

The measurement of laminar burning velocities using the constant-volume combustion vessel method, requires a knowledge of adiabatic flame temperatures during the process. A computer program has been written which calculates the constant pressure combustion equilibrium composition, adiabatic flame temperatures and burnt gas molecular weights over a range of pressures and unburnt gas temperatures for different gaseous fuel/air mixtures. The program employs the technique of minimization of the free energy of the products of combustion via the method of steepest descent. The mathematical analysis of the computational technique is included, together with a full program listing and detailed logic diagrams. Author

N74-10866# National Aviation Facilities Experimental Center, Atlantic City, N.J.
ULTRAVIOLET AND NEAR-INFRARED SPECTRAL ANALYSIS OF A BURNER-CAN BURN-THROUGH FLAME Final Report
Richard Hill Nov. 1973 27 p
(FAA-NA-73-86; FAA-RD-73-154) Avail: NTIS HC $3.50

The near-infrared and ultraviolet spectrum of a burner-can burn-through flame was analyzed using a J47 engine to produce the burn-through flame. Charts of the power output of the flame in the near-infrared and ultraviolet were produced for various engine power settings. Author

N74-10867# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMAL CONDUCTIVITY OF SOLIDS AT ROOM TEMPERATURE AND BELOW: A REVIEW AND COMPILATION OF THE LITERATURE Final Report
Gregg E. Childs, Lewis J. Ericks, and Robert L. Powell Sep. 1973 625 p refs Supersedes NBS-Circular-56
(NBS-Mono-131; LC-72-600311; NBS-Circular-556) Avail: SOD HC $7.80 Domestic Postpaid or $7.25 GPO Bookstore

A compilation is given of the measured values of thermal conductivity for nearly all solid materials from room temperature down to 0.01 Kelvin. The reviewed materials include elements, alloys and commercial metals, semiconductors, semimetals, ionic and valence crystals, minerals, molecular crystals, polymers, glasses, and disordered dielectrics. Excluded are foams, powders, earths, fibers, layers of composites, and similar other heterogeneous solids. Data for temperatures below 1 kelvin are presented separately. The tables and graphs are complete for literature references from 1900 to mid-1971. Experimental methods and physical phenomena are discussed in the text and coded in the tables for references for which curves are shown. Author

N74-10868# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF TEMPERATURE FIELDS IN MULTILAYER SHELLS
V. V. Frolov 14 Aug. 1973 23 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (Moscow), no. 4, 1971 p 112-121
(AD-766038; FTD-HT-23-603-73) Avail: NTIS CSCL 20/13

The nonsteady-state problem of thermal conductivity is considered in a multilayer shell shaped as a convex body of revolution. The formulation of the problem differs in that arbitrary nonlinear relationships are admissible as the boundary conditions on the outer and inner surfaces, and on the intermediate surfaces dividing the layers of the shell the solution and its normal derivative may undergo discontinuity. GRA

N74-10869# ARO, Inc., Arnold Air Force Station, Tenn.
LAMINAR HEAT TRANSFER ON SHARP AND BLUNT TEN-DEGREE CONES IN CONICAL AND PARALLEL LOW-DENSITY FLOW Final Report, 13 Mar. 1971 - 7 Apr. 1972
D. E. Boylan AEDC Aug. 1973 63 p refs
(AD-765546; ARO-VKF-TR-73-47; AEDC-TR-73-106) Avail: NTIS CSCL 16/3

The report presents heat-transfer-rate measurements on sharp and blunt 10-deg half-angle cones at angles of attack between -9 and -10 deg in a low-density, hypersonic wind tunnel. Circumferential and longitudinal distributions are presented for cold wall conditions for a range at Mach and Reynolds numbers. The effect of source-like flows was studied by utilizing both conical and contoured expansion nozzles with the same free-stream similarity parameters and model wall temperatures. Comparisons are made with previously published experimental and theoretical results. Author (GRA)

N74-10870# Army Foreign Science and Technology Center, Charlottesville, Va.
HEAT TRANSFER IN POROUS MEDIA
E. A. Meksimov 13 Mar. 1973 7 p refs Transl. into ENGLISH from Inz.-Fiz. Zh. (USSR), no. 4, 1971 p 588-591
(AD-765530; FSTC-HT-23-2002-72) Avail: NTIS CSCL 20/13

Results are given for studies of the rate of heat exchange in a porous material as a function of the properties of the coolant. GRA

N74-10871# Army Foreign Science and Technology Center, Charlottesville, Va.
DETERMINATION OF TEMPERATURES OF A FLOW AND OF A CHANNEL WALL CONTAINING HEAT
N. A. Minyailenko 13 Mar. 1973 7 p refs Transl. into ENGLISH from Teplofiz. Teplotekhnika (USSR), no. 18, 1970 p 52-56
(AD-765532; FSTC-HT-23-1973-72) Avail: NTIS CSCL 20/13

Many modern devices use constant heat sources and the heating of channels. The unsteady heat exchange processes occurring in such channels while heat carriers are being pumped through them are fairly complex so that it is important to know the temperature of the channel wall and flow in any cross-section and at any instant of time, and also the influence of basic factors thereon. The report considers cases in which the physical parameters of the heat carrier depend on temperature which

may be considered as constant, and in which the heat transfer coefficients are constant along the channel length. GRA

N74-10872# Naval Postgraduate School, Monterey, Calif.
JET PLUME DEVELOPMENT IN A THERMALLY STRATIFIED MEDIUM M.S. Thesis
Robert Douglas Brown Jun. 1973 114 p refs
(AD-765666) Avail: NTIS CSCL 13/2

The behavior of an incompressible jet injected into a stably stratified stagnant reservoir was studied in an attempt to define some new aspects of the thermal pollution problem. This experiment investigated the effects of injection angle, Reynolds Number (influence of turbulence), Rayleigh Number (influence of the total temperature of the jet), and reservoir temperature gradient on jet containment and flow stabilization. The nature of the study prohibited precise analytical evaluation of the results but observed tendencies could be qualitatively scrutinized to evaluate the inherent heat and transport problem. Results indicated the pronounced tendency of a reservoir temperature gradient to inhibit mass transport yet enhance heat transfer characteristics.
Author (GRA)

N74-10873# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
FORCED CONVECTION HEAT TRANSFER TO SUBCRITICAL HELIUM 1 Final Report
Patricia J. Giarrantano, R. C. Hess, and M. C. Jones May 1973 48 p refs Sponsored in part by Air Force
(Contract AT(49-2)-1165)
(AD-766221; NBSIR-73-322; AFAPL-TR-73-37) Avail: NTIS CSCL 20/13

Preliminary results of an experimental investigation of heat transfer to liquid helium under forced flow conditions are reported for a 0.213 cm i.d. x 10 cm long test section subject to the following range of operating conditions: System pressures 1.1 2.1 atm; Mass velocities 4 - 64 g/s-square cm; Heat fluxes 0.04 - 0.53 W/square cm; Inlet subcooling 0.03 0.10 K. The effect of the above system parameters on the heat transfer and critical heat flux is discussed; a comparison of forced convection boiling with other modes of heat transfer pool boiling and supercritical and the performance of centrifugal pump used for circulating the liquid helium are also included in the report.
Author (GRA)

N74-10874# Army Foreign Science and Technology Center, Charlottesville, Va.
CATALYTIC COMBUSITON OF CARBON MONOXIDE IN GASOLINE ENGINE EXHAUST USING MANGANESE CATALYSTS
V. T. Chagunava 7 Mar. 1973 58 p Transl. into ENGLISH of the mono. "Margantsevye Katalizatory Dlya Nekotoryh Reaktsii" USSR, 1969 p 128-174
(FSTC Proj. t7023012301)
(AD-760395; FSTC-HT-23-1248-72) Avail: NTIS CSCL 07/4

In the last 15 to 20 years, complex research work in the lowering of the toxicity of exhaust gases of the internal combustion engine has been done. Out of the various proposed methods, the broadest dissemination was achieved by the method of the catalytic afterburning of the products of incomplete fuel combustion in neutralizers. In the existing catalytic neutralizers that have been constructed abroad as well as in the Soviet Union, platinum either on various carriers or in alloys with other components was used as the catalyzer. Manganese catalyzers for the afterburning of the carbon monoxide in exhaust gases are being investigated in the Academy of Sciences of the Georgian Soviet Socialist Republic. Preliminary results of these investigations are given. GRA

N74-10875# Army Foreign Science and Technology Center, Charlottesville, Va.
DEVELOPING METHODS OF TRANSFERRING HEAT BY RADIATION AND THERMAL CONDUCTIVITY IN ABSORBING AND DISPERSING ENVIRONMENT
Yu. A. Surinov 6 Feb. 1973 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 1, 1971 p 124-131
(AD-759661; FSTC-HT-23-2285-72) Avail: NTIS CSCL 20/12

A study of a solution for a stationary problem of heat transfer by radiation and heat conduction is presented for an absorbing and isotropically dispersing gray medium for the case of its variable physical characteristics, which for the conditions of the diffusibility of limiting radiation is reduced to the generalized Dirchlet's problem. This problem is solved by methods of the theory of heat potentials or generalized heat potential depending on the manner of presenting heat transfer coefficient of an environment in the form of temperature functions or point functions. GRA

N74-10876# United Aircraft Corp., East Hartford, Conn. Research Labs.
NITRIC OXIDE FORMATION IN COMBUSTION PROCESSES WITH STRONG RECIRCULATION Final Report
C. T. Bowman, L. S. Cohen, and M. N. Director Jun. 1973 144 p refs
(Contract EPA-68-02-0252)
(PB-223003/5EPA-R2-73-291) Avail: NTIS HC $4.50 CSCL 21B

The principal objective of the combustion experiments was to obtain information on the nitric oxide formation process in a continuous flow combustion system in which the flame is stabilized by recirculation. Specifically, the factors affecting nitric oxide production in the recirculation zone were to be identified and the importance of nitric oxide production in the recirculation zone to overall nitric oxide production in the combustor was to be determined. A simplified experimental configuration was used to permit detailed examination of the nitric oxide formation process in the combustion. The amount of nitric oxide produced in the recirculation zone is known to depend on four principal factors-the recirculation zone volume, the temperature and residence time of the gas in the zone, and the O-atom concentration in the zone. The data were used to correlate nitric oxide production in the recirculation zone with the important zone characteristics.
GRA

N74-10268* Martin Marietta Corp., Denver, Colo.
INVESTIGATION OF CRITICAL DEFECTS IN ABLATIVE HEAT SHIELD SYSTEMS
C. C. Miller and W. D. Rummel *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 543-554 refs (For availability see N74-10232 01-11)
CSCL 20M

N74-10269* Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
PROPERTIES OF A CLOSED PORE INSULATION THERMAL PROTECTION SYSTEM
A. Tobin, C. Feldman, M. Russak, and J. Reichman *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 555-565 refs (For availability see N74-10232 01-11)
(Contracts NAS1-10713; NAS9-12781)
CSCL 20M

N74-10270* Martin Marietta Corp., Denver, Colo.
ABLATIVE HEAT SHIELD DESIGN FOR SPACE SHUTTLE
R. W. Seiferth *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 567-581 (For availability see N74-10232 01-11)
(Contract NAS1-11592)
CSCL 20M

N74-10273* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE VACUUM-ULTRAVIOLET DEGRADATION OF SALT-SPRAY-CONTAMINATED THERMAL CONTROL COATINGS
H. M. King and J. E. Gilligan (IIT Res. Inst., Chicago, Ill.) *In its* Space Simulation, 7th 1973 p 637-644 (For availability see N74-10232 01-11)
(Contract NAS8-28765)
CSCL 11C

N74-10294* Northrop Services, Inc., Houston, Tex.
HEAT TRANSFER AT SUBATMOSPHERIC PRESSURES, 1
Calvin M. Wolff and Thakor J. Vyas *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 919-933 refs

(For availability see N74-10232 01-11)
CSCL 20M

N74-10295* Los Alamos Scientific Lab., N.Mex.
A ROCKET-BORNE, LOW GRAVITY CRYOGENIC HEAT TRANSFER EXPERIMENT
K. D. Jr. Williamson, F. J. Edeskuty, and J. F. Taylor *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 935-942 refs Sponsored by AEC (For availability see N74-10232 01-11)
CSCL 20M

N74-10296* Martin Marietta Corp., Denver, Colo.
TEMPERATURE RISE FOR SPRING-LOADED PHASE CHANGE DEVICES
R. A. Farmer *In* NASA. Goddard Space Flight Center Space Simulation, 7th 1973 p 943-953 refs (For availability see N74-10232 01-11)
CSCL 20M

N74-10438 Institut Franco-Allemand de Recherches, St. Louis (France).
GAS DYNAMIC METHODS IN THEORETICAL INTERIOR BALLISTICS [GASDYNAMISCHE METHODEN IN DER THEORETISCHEN INNENBALLISTIK]
G. Krauth *In its* Papers on Ballistics and Phys. of Transience 1973 p 35-47 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

N74-10442 Institut Franco-Allemand de Recherches, St. Louis (France).
SPECTROSCOPIC TEMPERATURE MEASUREMENT IN THE WAKE OF ABLATING FLYING DURALUMINUM SPHERES [SPEKTROSKOPISCHE TEMPERATURMESSUNGEN IM NACHLAUF VON FREIFLIEGENDEN ABLATIERENDEN FLUGKOERPERN AUS DURAL]
H. Mach *In its* Papers on Ballistics and Phys. of Transience 1973 p 124-139 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

N74-10444 Institut Franco-Allemand de Recherches, St. Louis (France).
GROWTH AND INVESTIGATION OF SOME PROPERTIES OF EXPLOSIVES SINGLE CRYSTALS [SPRENGSTOFF-EINKRISTALLE, IHRE ZUECHTUNG UND UNTERSUCHUNG EINIGER EIGENSCHAFTEN]
H. W. Koch *In its* Papers on Ballistics and Phys. of Transience 1973 p 159-184 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

N74-10445 Institut Franco-Allemand de Recherches, St. Louis (France).
TESTS ON SHOCK INDUCED METHANE COMBUSTION [UEBER EINIGE VERSUCHE ZUR STOSSINDUZIERTEN VERBRENNUNG VON METHAN]
H. F. Lehr and H. Behrens *In its* Papers on Ballistics and Phys. of Transience 1973 p 185-199 refs In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N74-10877 National Lending Library for Science and Technology, Boston Spa (England).
PHOTOMETRIC CATALOGUES AND STANDARDS
A. S. Sharov and N. N. Yakimova Jul. 1973 6 p Transl. into ENGLISH from Tr. Gos. Astron. Inst. (Moscow), v. 40, 1970 p 106-108
(NLL-RTS-8187) Avail: Natl. Lending Library, Boston Spa, Engl.: £10.50 or 2 NLL photocopy coupons

Lists of photometric U, (U sub c), B, and V catalogs and standards are contained in this indexed bibliography. G.G.

N74-10878* New Mexico Univ., Albuquerque.
PUBLIC SCIENCE POLICY AND ADMINISTRATION
Albert H. Rosenthal, ed 1973 337 p refs
(Contract NGL-32-004-042)
(NASA-CR-136019) Copyright. Avail: Issuing Activity HC $12.00 CSCL 05A

Science, the overwhelming concern of our time, is no longer a matter of private research and development but one of public policy and administration, in which government, industry, foundations, and educational institutions must all work together as never before. Few other single tasks are of such decisive importance to the collective and individual welfare of American citizens as the formulation of public science policy and the administration of scientific programs. Eleven national authorities of varied background in science, education, and government administration contribute their experience and their judgment in an effort to deal with the major aspects of the subject. Their focus is on the meeting of actual problems; they consider the decision making process in both public and public-private organizations. Topics are grouped in three general categories: personnel needs and resources, organizational problems and techniques, and the administrative role in policy leadership.
Author

N74-10879*# Tennessee Univ. Space Inst., Tullahoma.
MANAGEMANT OF NASA'S MAJOR PROJECTS
Lee B. James Jul. 1973 186 p refs
(Grant NGR-43-001-116)
(NASA-CR-135989) Avail: NTIS HC $11.50 CSCL 05A

Approaches used to manage major projects are studied and the existing documents on NASA management are reviewed. The work consists of: (1) the project manager's role, (2) request for proposal, (3) project plan, (4) management information system, (5) project organizational thinking, (6) management disciplines, (7) important decisions, and (8) low cost approach. T.M.R.

N74-10880# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 359
9 Oct. 1973 29 p refs Transl. into ENGLISH from various Eastern European publications
(JPRS-60224) Avail: NTIS HC $3.50

Articles are presented concerning the mission planning for orbiting an infrared spectrometer, the Bulgarian computers at the Plovdiv Fair, and fluoresence microscope. For individual titles, see N74-10881 through N74-10883.

N74-10881 Joint Publications Research Service, Arlington, Va.
SESSION ON SPACE RESEARCH REPORTED c13
Gy. Major, K. Orendi, E. Borbely, T. Tanczer, B. Kozak, and P. Ambrozy *In its* Transl. on Eastern Europe: Sci. Affairs, No. 359 (JPRS-66224) 9 Oct. 1973 p 1-5 refs Transl. into ENGLISH from Idojaras (Budapest), May-Jun. 1973 p 190-192 (For availability see N74-10880 01-34)

The conferences are reported which were held for planning the placement of an infrared spectrometer into earth orbit aboard a Soviet satellite. F.O.S.

N74-10882 Joint Publications Research Service, Arlington, Va.
EXHIBIT OF ELECTRONIC COMPUTERS IN PLOVDIV c08
I. Beteva *In its* Transl. on Eastern Europe: Sci. Affairs, No. 359 (JPRS-66224) 9 Oct. 1973 p 6-7 Transl. into ENGLISH from Otechestven Front (Sofia), 8 Sep. 1973 p 1 (For availability see N74-10880 01-34)

The Bulgarian computers and components displayed at the Plovdiv Fair are briefly described. The ES-1020 digital computer, ES-5061 memory unit, Izot-3010, and the Elka series of calculators are discussed. F.O.S.

N74-10883 Joint Publications Research Service, Arlington, Va.
FLUORESCENCE MICROSCOPE OF THE MIKROVAL TYPE FROM VEB CARL ZEISS JENA c14
L. Otto *In its* Transl. on Eastern Europe: Sci. Affairs, No. 359

(JPRS-66224) 9 Oct. 1973 p 8-19 refs Transl. into ENGLISH from Z. fuer Med. Labortech. (East Berlin), v. 14, no. 4, 1973 p 1-95-203 (For availability see N74-10880 01-34)

Two fluorescence microscopes are described, and their methodology and technical advantages are explained. The first instrument (Fluoval) is a general-purpose fluorescence microscope, fitted for transmitted light, incident light, and combined beam techniques. The second instrument (Ergaval) is a similar apparatus, which is equipped for transmitted light only. The Fluoval is fitted with a HBO 200, the Ergaval with a HBO 50. Both instruments are equipped with identical filters, thus permitting long wave ultraviolet, blue violet, and blue excitation. There is provision for visual observation and photography. Author

N74-10884# Joint Publications Research Service, Arlington, Va.
TRANSLATIONS FROM PRIRODA, NO. 6, 1973
11 Oct. 1973 18 p refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1973 9 p
(JPRS-60251) Avail: NTIS HC $3.00

Articles are presented on two objects suggested in search for extraterrestrial populations, gravitational waves proposed for communicating with other worlds and distress and alarm signals of ants. A book review of developments in bioenergetics is included. For individual titles, see N74-10885 through N74-10886.

N74-10885 Joint Publications Research Service, Arlington, Va.
TWO OBJECTS SUGGESTED IN SEARCH FOR EXTRATERRESTRIAL POPULATIONS **c30**
G. I. Pokrovskiy *In its* Transl. from Priroda, No. 6, 1973 (JPRS-60251) 11 Oct. 1973 p 1-3 refs Transl. into ENGLISH from Priroda (Moscow), no. 6, 1973 p 97-98 (For availability see N74-10884 01-34)

The radiation spectrum of orbital ring structures surrounding a star similar to the sun is discussed in terms of energy distribution. Object R in the constellation Monoceros, and object T in the constellation Taurus are suggested for study in searches for highly developed civilizations on other planets. F.O.S.

N74-10886 Joint Publications Research Service, Arlington, Va.
GRAVITATIONAL WAVES PROPOSED FOR COMMUNICATING WITH OTHER WORLDS **c07**
V. B. Kudrin *In its* Transl. from Priroda, No. 6, 1973 (JPRS-60251) 11 Oct. 1973 p 4-5 Transl. into ENGLISH from Priroda (Moscow), no. 6, 1973 p 98-99 (For availability see N74-10884 01-34)

Gravitational radiation is discussed as the solution to the problem of communication with civilizations on other planets. The properties of gravity waves are also discussed. The probability of discovering a civilization of the contemporary (radio civilization) is considered to be negligible. F.O.S.

N74-10887*# System Development Corp., Falls Church, Va.
DIRECTORY OF AEROSPACE SAFETY SPECIALIZED INFORMATION SOURCES
Eleanor A. Fullerton and Linda S. Rubens Oct. 1973 243 p refs
(Contract NAS3-16540)
(NASA-CR-121206) Avail: NTIS HC $14.25 CSCL 05B

A directory is presented to make available to the aerospace safety community a handbook of organizations and experts in specific, well-defined areas of safety technology. It is designed for the safety specialist as an aid for locating both information sources and individual points of contact (experts) in engineering related fields. The file covers sources of data in aerospace design, tests, as well as information in hazard and failure cause identification, accident analysis, materials characteristics, and other related subject areas. These 171 organizations and their staff members, hopefully, should provide technical information in the form of documentation, data and consulting expertise. These will be sources that have assembled and collated their information, so that it will be useful in the solution of engineering problems. One of the goals of the project in the United States that have and are willing to share data of value to the aerospace safety community. Author

N74-10888*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
MOTIVATION: A SELECTED BIBLIOGRAPHY
Sep. 1973 50 p refs Revised
(NASA-TM-X-69473; KSC-GP-816-Rev) Avail: NTIS HC $4.50 CSCL 05B

A bibliography is presented of books, periodicals, and documents concerning managerial motivation. F.O.S.

N74-10889# Weapons Research Establishment, Salisbury (Australia).
[WEAPONS RESEARCH AND DEVELOPMENT ACTIVITIES] Annual Report, 1972 - 1973
1973 57 p refs
Avail: NTIS HC $5.00

The research and development activities of the Weapons Research Establishment of Australia are presented. The trials activities, advanced technology and engineering techniques, and consultation and services are described. The specific subjects discussed include: (1) oceanography, (2) sound ranging, (3) radio wave propagation, (4) ionospheric ground backscatter sounding, (5) wind measurements in the lower atmosphere, and (6) propellant ignition and combustion. Author

N74-10890# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
IN PLACE OF CONGESTION: SOME OBSERVATIONS ON THE TRANSPORT OF FREIGHT
Ralf Bonwit Jul. 1973 115 p refs
(TT-7308) Avail: NTIS HC $7.75

An assessment of freight transport technology is presented with emphasis on land and air transport for highly industralized countries. The modal split between rail and road freight transport for Europe and North America is discussed along with forecasts of freight movements between 1970 and 1990. Pipeline systems, air freight, urban goods delivery, freight consolidation centers, and automatic handling are analyzed. It is concluded that the decisive factor for the severe impact of freight transport on Britain was not the lack of technology, but failure to apply it. F.O.S.

N74-10891# Stichting Nationaal Lucht- en Ruimtevaartlaboratorium, Delft (Netherlands).
STICHTING NATIONAL AEROSPACE LABORATORY, REVIEW FOR THE YEAR 1972 [STICHTING NATION AAL LUCHT- EN RUIMTEVAARTLABORATORIUM VERSLAG OVER HET JAAR 1972]
1972 119 p refs In DUTCH; ENGLISH summary
Avail: NTIS HC $8.00

Aerospace research activities during 1972 included the following topics: The development of a method for calculating three-dimensional turbulent boundary layers; crack propagation in titanium alloys; various computations for aircraft development using wind tunnel results; fatigue and fracture toughness of aircraft construction materials; approach and landing control; and environmental and earth surface surveys. G.G.

N74-10892# Committee on Science and Astronautics (U. S. House).
ENERGY RESEARCH AND DEVELOPMENT AND SPACE TECHNOLOGY
Washington GPO 1973 574 p refs Hearings before Subcomm. on Space Sci. and Appl. and Subcomm. on Energy, 93d Congr., 1st Sess., No. 9, 7, 22, and 24 May 1973
Avail: Comm. on Sci. and Astronaut.

A Congressional hearing on energy research and development was conducted. The circumstances leading to the present energy crisis are discussed. The various methods for obtaining energy from solar, geothermal, wind, and tidal sources are defined. The projects which are expected to produce new methods for obtaining energy are analyzed. Author

N74-10893*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FISCAL YEAR 1973 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
Oct. 1973 102 p refs
(NASA-TM-X-69469; MS-I-73-01) Avail: NTIS HC $7.25 CSCL

05B

Formal NASA technical reports, papers published in technical journals, and presentations by MSFC personnel in FY73 are presented. Papers of MSFC contractors are also included.
Author

N74-10894# National Science Foundation, Washington, D.C.
RESEARCH AND DEVELOPMENT IN INDUSTRY 1971: FUNDS, 1971; SCIENTISTS AND ENGINEERS, JANUARY 1972
May 1973 96 p refs
(NSF-73-305) Avail: SOD HC $1.65

Statistics are provided on industrial R and D by source of financing, character of work, and geographic distribution. Data on basic research are presented by field of science; details on applied research and development are shown by product field. Information is also given on the number of industrial R and D scientists and engineers as of January 1972. Author

N74-10895# Committee on Science and Astronautics (U. S. House).
OFFICE OF TECHNOLOGY ASSESSMENT: BACKGROUND AND STATUS
Walter A. Hahn and Rosemary Chalk Washington GPO Aug. 1973 55 p refs Presented to Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., 30 Jul. 1973 Based on CRS Multilith No. 73-41 SP Prepared by Library of Congr.
Avail: Comm. on Sci. and Astronaut.

The background and status of the Office of Technology Assessment are presented in a report to the Committee on Science and Astronautics of the U.S. House of Representatives. It is stated that the basic function of the office is to provide early indications of the probable beneficial and adverse implications of the applications of technology and to develop other coordinate information which may assist the Congress. The legislative history leading to the creation of the office is analyzed. The final legislation in the form of the Technology Assessment Act of 1972 is included. Author

N74-10896# Committee on Science and Astronautics (U. S. House).
SOLAR ENERGY FOR THE TERRESTRIAL GENERATION OF ELECTRICITY
Washington GPO 1973 51 p Hearing before Comm. on Sci. and Astronaut., 93d Congr., 1st Sess., No. 12, 5 Jun. 1973
Avail: Subcomm. on Energy

The hearings are presented concerning the concept of terrestrial power stations that convert solar energy into electricity. Solar power farms are discussed, and a solar collector system is described. F.O.S.

N74-10897# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
AEROSPACE ACTIVITIES Annual report, 1972
Jun. 1973 143 p refs
Avail: NTIS HC $9.25

The 1972 ONERA annual report covers the following: adminstration; spacecraft testing facility; aerodynamics department activities; Modane large wind tunnel; structures; physics; materials; computing center; and Toulouse Research Center. A list of patents, news releases, publications, and technical notes with abstracts, technical memoranda, and films is given. ESRO

N74-10898# Army Foreign Science and Technology Center, Charlottesville, Va.
SIGNIFICANT RESEARCH RESULTS FOR 1971, HIGH TEMPERATURE INSTITUTE, USSR ACADEMY OF SCIENCES
25 Jun. 1973 103 p refs Transl. into ENGLISH of the publ. "Vazhneishie Rezultaty Nauchno-Vysokikh Temperatur, Akademii Nauk SSSR" Moscow, Nauka, 1972
(AD-765753; FSTC-HT-23-1016-73) Avail: NTIS CSCL 07/4

The Institute's work continued in 4 basic directions in 1971: (a) study of thermophysical and electrophysical properties of substances at high temperatures; (b) study of high-temperature heat and mass transfer and gas dynamics processes; (c) development and study of new heat-resistant structural materials; and (d) research toward development of direct conversion of heat into electricity using MHD generators and other new types of energy units. Properties of plasmas, especially of cesium plasmas, at high temperatures (p + or - 500 atm, t + or - 5000K and higher) were studied. Measurements made by the electrical explosion method were made on Fe, Ni, W, Mo and various transition group metals (entropy, enthalpy, heats of fusion, for example). Experimental and theoretical determination of phase diagrams, of e.g. Li-LiH-H2 systems, were prepared, especially at high temperatures and low pressures. Heat and mass transfer and gas dynamics properties of high-temperature heat transfer agents was emphasized. ZrO2-Y2O3-CeO2 based electrodes, as well as LaCrO2-Cr, cermetselectrodes, and high-alumina MgO base cements for insulating materials were studied for MHD applications. The U-25 MHD (magnetohydrodynamics) unit was started up and successfully run in 1971. Power of 75 kW was achieved in MHD generator tests. Various MHD channel configurations were tested extensively. Theoretical studies on the most efficient uses of MHD generators in an electrical power network were made, especially as to their use to carry peak loads on a system. GRA

N74-10899# AAI Corp., Baltimore, Md.
HIGH LEVEL CONTAINER Final Technical Report
Anthony L. Farinacci and Don B. Bruner Mar. 1973 125 p refs
(Contract DAAG17-72-C-0075)
(AD-766306; ER-7194; USA-NLABS-TR-73-55-AD) Avail: NTIS CSCL 15/7

A study was conducted to identify feasible approaches for the airdrops of containerized cargo from aircraft flying at heights beyond the reach of certain types of ground fire. The primary application would be the resupply of combat units which on occasion may necessarily be within close proximity to enemy forces. Concepts for equipment and techniques were generated and evaluated for their ability to guide the containers through the airspace and land safely in the limited area of the drop zone. Author

N74-10900# Naval Air Engineering Center, Philadelphia, Pa. Ground Support Equipment Dept.
MARINE AIR GROUP OXYGEN AND NITROGEN DEMANDS Final Report
Thomas Dale Weikel Jul. 1973 28 p refs
(AD-765696; NAEC-GSED-70) Avail: NTIS CSCL 15/5

U.S. Marine Air Group consumption of liquid oxygen and nitrogen is reported. Several alternate methods of satisfying this demand are presented; such as mobile generators and local purchase. Author (GRA)

N74-10901# Army Research Office, Durham, N.C.
RESEARCH IN PROGRESS DURING CALENDAR YEAR 1972
1972 415 p refs
(AD-766223) Avail: NTIS CSCL 05/2

Reports are presented on Army research investigations in nuclear, atomic, molecular, plasma, and general physics; cryophysics and liquids; electromagnetic radiation and optics; inorganic, analytical, organic, structural, polymer, and electrochemistry; mathematics, operations research, statistics, and information sciences; materials, fluid mechanics, electronics, and power; metallurgy and ceramics; and environmental sciences. GRA

N74-10902# Brown Univ., Providence, R.I.
MATERIALS SCIENCES PROGRAM Annual Technical Report no. 11, 1 Jul. 1971 - 30 Jun. 1972
May 1973 126 p refs
(Contract DAHC15-67-C-0217)
(AD-766144) Avail: NTIS CSCL 05/2

The report contains summaries of research in the following areas of materials sciences: low temperature properties of materials: metals (normal and superconducting), semiconductors, insulators, helium; properties of materials at higher temperatures: metals, semiconductors, insulators, liquid metals; properties of surfaces and films; inorganic chemical compounds: structure and properties; molecular structure and intermolecular forces; dislocations and other defects; physical metallurgy: powder metallurgy, deformation studies; magnetic materials; noncrystalline solids: structure and properties; mechanical behavior

of materials; ultrasonics and acoustics; non-linear optics; devices and application; mathematical - theoretical. GRA

N74-10903*# IIT Research Inst., Chicago, Ill.
TECHNOLOGY TRANSFER TO A DEVELOPING NATION Final Report
C. A. Stone and S. J. Uccetta 1973 80 p
(Contracts NASw-2083; PASA-TA(ZA)-7-70)
(NASA-CR-135990; PB-222584/5) Avail: NTIS HC $3.75 CSCL 05C

The purpose of the pilot project was to test the feasibility of transferring selected types of industrial technology into the mainstream of industrial activities of a developing country, in such a way as to accelerate industrial development and enable it to bypass some intermediate development steps. The report presents a retrospective critique of the pilot project and attempts to relate these findings to other developing countries, although it is recognized that each country will have requirements peculiar to its needs and capabilities. Author (GRA)

N74-10904# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
MOD-METRIC TESTED FOR BIAS M. S. thesis
Lykes S. Henderson, Jr. and Russell W. Arendell 7 Mar. 1973 108 p refs
(AD-760081; SLSR-4-73A) Avail: NTIS CSCL 15/5

The original intent of the thesis was to develop a revised stocking model that specifically considered a recent technological improvement in the maintainability design of certain weapons systems. This improvement seemed to offer great potential for reduced inventory investment. The Air Force introduced a modular repair concept with the F-111 aircraft in the early 1960's, but no new stocking model had been considered for improving management techniques. In July of 1972 Captain John Muckstadt of Headquarters, Air Force Logistics Command, commenced work on a revised model for solving the problem. The thesis effort was then diverted from designing a new model to the study of Muckstadt's technique and the testing of his model for bias. GRA

N74-10436 Institut Franco-Allemand de Recherches, St. Louis (France).
DEVELOPMENT OF INTERNATIONAL SCIENTIFIC TECHNICAL INSTITUTIONS [ZUR ENTWICKLUNG INTERNATIONALER -WISSENSCHAFTLICH-TECHNISCHER INSTITUTIONEN]
R. Schall *In its* Papers on Ballistics and Phys. of Transience 1973 p 4-14 In GERMAN; ENGLISH summary (For availability see N74-10435 01-14)

N74-10441 Bundesamt fuer Wehrtechnik und Beschaffung, Koblenz (West Germany).
THE MOST IMPORTANT TYPES OF ARTILLERY WEAPONS. COMPARISON OF THEIR PHYSICAL FUNCTIONS [DIE WICHTIGSTEN SCHUSSWAFFENTYPEN. PHYSIKALISCHER VERGLEICH IHRER FUNKTIONSWEISEN]
E. Zwarg *In* Inst. Franco-Allemand de Rech. Papers on Ballistics and Phys. of Transience 1973 p 96-123 *In* GERMAN; ENGLISH summary (for availability see N74-10435 01-14)